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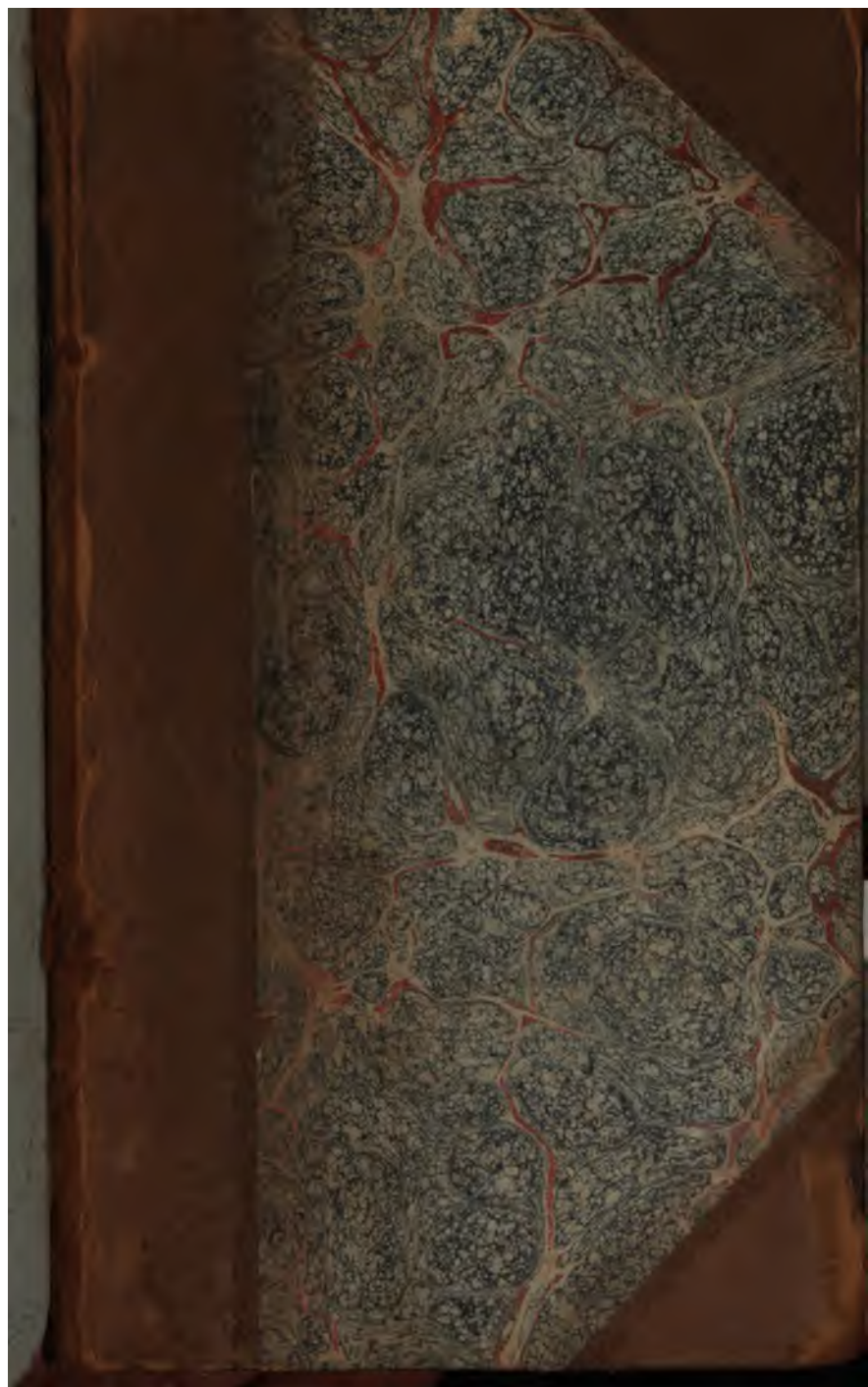
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A *S. H. 1832.*  
NEW SYSTEM  
OF  
GEOGRAPHY AND ASTRONOMY,  
OR  
A VIEW  
OF  
THE EARTH AND HEAVENS;

CONTAINING  
AN ACCOUNT OF THE FEATURES, MAGNITUDE, AND MOTIONS,  
OF THE EARTH; AND ALSO THE DIAMETER, MEAN  
DISTANCES FROM THE SUN, AND THE ANNUAL  
PERIODS, OF THE PLANETARY BODIES:

PRECEDED BY

*A copious set of Geographical and Astronomical Definitions, and  
illustrated by numerous Problems, by the application of which the  
Student can determine the rising and setting of the Stars; the  
Moon's southing, and the appearance which the Heavens present to  
the Earth at any instant of time, by a*

MENTAL CALCULATION.

BY

W., AND G. FROST, F. R. A. S.

TEACHERS OF WRITING, ARITHMETIC, GEOGRAPHY, AND ASTRONOMY, IN  
SCHOOLS AND PRIVATE FAMILIES.



LONDON:

SOLD BY SIMPKIN AND MARSHALL, STATIONERS' COURT.

1831.

82.

**PRINTED BY GEORGE SMALLFIELD, HACKNEY.**

## PREFACE.

---

GEOGRAPHY is a science which forms so essential a part of a liberal education, and is so admirably calculated to blend amusement with instruction, as readily to account for the great and increasing number of books on this subject. An acquaintance with the general *divisions* of the earth, the boundaries of empires and kingdoms, the names, bearings, and relative situations of cities, the manners, customs, and political relations of the inhabitants, is useful to all, and particularly to the politician, the navigator, and the merchant. Without a knowledge of the different tracts of land, the oceans and seas, comparatively little intercourse could be carried on with the people of distant regions.

All the plans which have hitherto been offered to the public have had their advantages, while they have failed to preclude the necessity of fresh attempts towards the completion of the object for which they were intended. As perfection can be acquired by time only, that plan which in the absence of a better was considered *good*, may, by care and attention, and by consi-

dering its defects, be improved, to the ease of the teacher and the advantage of the pupil.

The present mode of teaching Geography differs entirely from the plans recommended in other elementary works on this subject. In other treatises the pupil is required to commit to memory the names of certain *cities, seas, oceans, &c.*, without considering their relative positions and bearings: in this he will be able to bring before his imagination any part of the earth—on which he can name not only the *countries, mountains, lakes, seas, and rivers*, but their lengths, extent, and outlines, and the features of the intervening country. He can also distinctly perceive the source and course of rivers, the cities on their banks, and the route of the merchant, not only through the vast regions of central Asia, and the wilds of Africa, but likewise over the lofty Cordilleras, and across their deep valleys. He mentally beholds the sun revolving round the earth, and each *country* and *city* enlightened by his beams, at any hour of the day—the places to which he is then *vertical*, and where he is *rising* and *setting*: at the same time he sees summer and winter opposed to each other, and observes the progress of spring and autumn to their respective parts of the earth.

On the contrary, the pupil who commits to memory a portion of his Geography, and points out on his map the places he meets with in his

lesson, acquires only that information which the lapse of a few hours in the play-ground may totally erase from his recollection. He has said his lesson, and beyond the hour employed in learning it, he often cares but little. The design of education is considered by him as unimportant; he finds the bud bitter, and thinks it impossible that the fruit can be sweet. Many who have been engaged in tuition, have found how difficult it is to stimulate the understanding in proportion to the activity of the memory, and that the celerity of repetition is often mistaken for understanding. To obviate these impediments to mental culture, and to call reason and facts to the aid of memory, are the objects of the following treatise.

By the assistance of *words* containing letters of a numerical value, the pupil acquires the knowledge of the distance and bearing of one place from another, his imagination becomes a map, on which he traces the varied face of the globe; he traverses with ease the wilds of Africa; and, though a tarry-at-home traveller, delineates his journey from Cape Comorin to Cape Taimura, in Asia.

But this treatise is not confined merely to an improved method of teaching Geography: Astronomy, which it has been generally supposed can be learned by the mere mechanical solution of problems on the celestial globe, is here developed as a pleasing and instructive science, by

which the student, after making himself acquainted with the globes, effects his solutions mentally with more accuracy than he did with those instruments: the walls of the room in which he sits form his hemisphere, on which he pictures the constellations, and by which he is enabled, with comparatively little difficulty, to ascertain the right ascension, declination, and longitude, the time of the rising, culminating, and setting, of any star that may be named to him; he proves to what places the sun is vertical, what places are in darkness, and what places, for the time, have constant day: he calculates, for a given latitude, the periodic revolutions of the moon, and describes her approach and the duration of her light. The lines which contain the Mnemonics, the authors are aware, are not sufficiently rhythmical for poetry, but those persons who are aware of the difficulty of forming sentences which are to contain particular words, and of arranging these sentences so that they may have a reference to the history of the constellation or country, will, it is hoped, accept the attempt to do that *usefully*, though *indifferently*, which has never been done *well*.

W. AND G. FROST.

Hackney, Aug. 1, 1831.



## INTRODUCTORY REMARKS.

THE object of the following series of lessons is first to make the pupil acquainted with the figure of the earth and its grand divisions, whether they be *natural* or merely the imaginary circles surrounding it, since without understanding these the pupil cannot acquire a correct knowledge of the diversity existing in the animal and vegetable kingdoms, as this diversity has its distinct and marked features according to the proximity of a region to the *Equator*, *Tropics*, and *Arctic Circles*.

The circles necessary to be known are few in number, and easily comprehended by young persons, and when once known, the science of Geography becomes not only useful but pleasing and interesting; they are the *stepping-stones* to Zoology and Botany, for each species has its peculiar zone. These circles being considered the elements of the science of *Geography*, our next object is to describe the two constituent parts of the earth, *land* and *water*, together with their subdivisions, and to give a reason why certain

parts of land and water have particular names given to them, and in what respects they resemble each other. We then point out those parts of the earth where the greatest diversity exists in the colour, form, and intellect, of the human race, the great characteristics of which are found to be identified with the three grand zones of Terrestrial Climates, viz. the Torrid, Temperate, and Frigid Zones—then the diversity existing generally in the animal and vegetable kingdoms. We next give the divisions of *Europe*, *Asia*, *Africa*, and *America*, (taking each separately,) their boundaries and physical features; also the lengths of seas, oceans, gulfs, straits, and the number of islands in each, the heights of mountains, the directions they take, the course of rivers caused by such direction, and the length of each mountain range, and describe the face of each country, as depending upon the mountains or rivers, with the source and length of the latter. And, lastly, we enable the student to put down each capital of a kingdom in its true situation as to longitude and latitude, and to name the distance of one city from another with its bearing, in geographical miles, and, by increasing them 1-6th, in English miles. In order to accomplish these useful purposes, we recommend our pupils or readers to copy on a slate, or paper, first, the map of Europe, according to the order of bearing and distance as given in p. 44, taking

means of recollecting the bearings of cities, taking

the distance between London and York as a scale to measure all the other distances.

For the sources and terminations of most rivers mentioned in this work we have been indebted to Smallfield's "*Potamology, or a Tabular Description of the Principal Rivers throughout the World,*" to which we invite attention. That Table, on examination, will be found to contain outlines for a most extensive and accurate knowledge of the earth's surface. We recommend our pupils or readers to take the best Atlas they possess, and to trace in it the course of the first river described, viz. the Danube. The name of each river is associated with the country in which it takes its rise. The nearest town to its source is named, and its course is minutely described; so that by tracing it, the pupil may be impressed with a distinct view of the countries traversed or divided by it, in its numerous meanders, the bearing of each of which is specified. The large towns standing on its banks are mentioned in the order of the descent of the stream, and whether they are on the *left* or the *right* bank. The ocean, sea, or lake, into which each river falls, is stated: the chief town at or near the termination of the stream is also specified. From this detail it will be obvious that the above-mentioned Table would form a suitable accompaniment to our work, in which, by means of a *Memoria Technica*, we have endeavoured to afford our pupils a ready means of recollecting the bearings of cities, lakes,



seas, and points of the continents, &c., from one another, as well as the longitudes and latitudes of cities; nor can we omit to mention, that the tracing of rivers will enable our pupils more duly to appreciate the importance of those mountains or elevated plateaux from which rivers take their rise, or through which they wind their majestic courses.

(Since our last sheet on Africa went to press, the account of the discovery of the Niger's termination by the Messrs. Lander, has appeared in Blackwood's Magazine for July, 1831. They describe its source as being on the Eastern side of Mount Loma, in  $9^{\circ} 15'$  North latitude and  $9^{\circ} 36'$  West longitude, about 200 miles East of Sierra Leone. Under the name of the Joliba it bends its course North-east to Bamakoo; it then runs due East about 420 miles; afterwards winding the same distance North-east to Timbuctoo, and then bearing nearly South to the Gulf of Guinea, it discharges itself, by several mouths, at the Bight of Biafra. Thus have Messrs. Lander set at rest the question respecting that noble river's source and termination.)

The pupil is next exercised in calculating mentally most of the problems usually solved by the globes. Having ourselves for many years been accustomed to teach from Mr. Bourn's edition of Mr. Butler's Exercises on the Globes, we strongly recommend that valuable *tréatise* to precede or accompany our problems. The merits

of that work are too well known and appreciated to need any comment from us. The following PROBLEMS are not intended by any means to supersede the Use of the Globes, but to impart the means of solving those problems, mentally which the student has performed mechanically, and to apply what he has learned to the motions of the earth, and to the apparent motions of the heavens themselves.

Maps of the four quarters have been omitted, as most pupils are in possession of an Atlas containing maps superior to those generally to be met with in books of this size.

## ERRATA.

Page 29, line 5, for 'E. of Jutland Channel' read *W.*

33, — 27, for 'half a day's (30 m.)' read *two days' (120 m.)*.

After p. 119, for (20) read (120).

Page 258, line 5 of the note, between 'to' and 'in' insert *by*.  
265, — 26, for 'when' read *where*.

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## OPINIONS RELATING TO THE ASTRONOMY.

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I HAVE tried Mr. FROST on several problems, and found that, by his Mental Arithmetic, he could with great ease tell the position of a star named, which I could not have done without application to the Globe; and it does not seem to me that his method is difficult of acquisition. The Pupil, of course, must be attentive; and by following his instructions and noticing at night the position of the stars, he will, in a little time, acquire a knowledge which will never after be forgotten.

W. FRIEND.

Mr. W. FROST has given a short course of lessons in Practical Astronomy in my house, and the result of them induces me to consider the plan which he pursues as very useful, and likely to enable an attentive Pupil to acquire in a short time a clear knowledge of that science.

*Stamford Hill.*

C. E. A. SCHWABE, D. D.

Having carefully informed myself of Mr. FROST's method of teaching Astronomy, I am fully convinced of its practical utility, as rendering the Pupils familiar with the motions of the heavenly bodies, and their position in the heavens at any particular time; and affording thereby much instruction and pleasure, and enabling them to point out at any time the various fixed stars and planets which may be above the horizon.

JAMES MITCHELL, LL.D.

Mr. FROST has given, in consequence of the vacation, only eight lessons to my Pupils, on Mental Astronomy; yet the progress they have made, and the facility with which they have made their calculations, have astonished me.

*Blemel House, Brompton,  
1st July, 1830.*

R. B. POLLARD.

Having examined this system and witnessed its efficiency, I can recommend it with confidence.

*Hackney, July 4th, 1830.*

T. BOURN.

## OUTLINE GEOGRAPHY.

---

### LESSON I.

*Geography; Sun; Planets, Primary and Secondary.*

1. *GEOGRAPHY* is a science which treats of the earth's surface.

2. *Geography* is compounded of the two Greek words *Ge* (Terra the Earth) and *grapho* (to describe).

3. The *Earth* is opaque, from *opācus*, (dark,) and solid. It has length, breadth, and thickness.

4. The *Earth* is called a planet, from *planētēs* (wanderer), because it moves in an orbit (*orbis*, circle) round the sun.

5. The *Sun*, the source of light and heat, is called a fixed star, and is the centre of the Solar System, round which the primary planets move in circular orbits, or ellipses, which ellipses are the measures of their years.

6. There are eleven Primary planets, and eighteen Secondary planets : these constitute the Solar System.

7. The *primary planets* are so called because they move round the sun as a centre.

8. The *secondary planets* are so called because they move round the primary planets as centres. The *secondary planets* are called moons or satellites, from *satelles* a guard or attendant upon another. The primary planets revolve round the sun in the following order :



parts of land and water have particular names given to them, and in what respects they resemble each other. We then point out those parts of the earth where the greatest diversity exists in the colour, form, and intellect, of the human race, the great characteristics of which are found to be identified with the three grand zones of Terrestrial Climates, viz. the Torrid, Temperate, and Frigid Zones—then the diversity existing generally in the animal and vegetable kingdoms. We next give the divisions of *Europe*, *Asia*, *Africa*, and *America*, (taking each separately,) their boundaries and physical features; also the lengths of seas, oceans, gulfs, straits, and the number of islands in each, the heights of mountains, the directions they take, the course of rivers caused by such direction, and the length of each mountain range, and describe the face of each country, as depending upon the mountains or rivers, with the source and length of the latter. And, lastly, we enable the student to put down each capital of a kingdom in its true situation as to longitude and latitude, and to name the distance of one city from another with its bearing, in geographical miles, and, by increasing them 1-6th, in English miles. In order to accomplish these useful purposes, we recommend our pupils or readers to copy on a slate or paper, first, the map of Europe, according to the order of bearing and distance as given in p. 44, taking means of recollecting the bearings of cities, &c.

the distance between London and York as a scale to measure all the other distances.

For the sources and terminations of most rivers mentioned in this work we have been indebted to Smallfield's "*Potamology, or a Tabular Description of the Principal Rivers throughout the World,*" to which we invite attention. That Table, on examination, will be found to contain outlines for a most extensive and accurate knowledge of the earth's surface. We recommend our pupils or readers to take the best Atlas they possess, and to trace in it the course of the first river described, viz. the Danube. The name of each river is associated with the country in which it takes its rise. The nearest town to its source is named, and its course is minutely described; so that by tracing it, the pupil may be impressed with a distinct view of the countries traversed or divided by it, in its numerous meanders, the bearing of each of which is specified. The large towns standing on its banks are mentioned in the order of the descent of the stream, and whether they are on the *left* or the *right* bank. The ocean, sea, or lake, into which each river falls, is stated: the chief town at or near the termination of the stream is also specified. From this detail it will be obvious that the above-mentioned Table would form a suitable accompaniment to our work, in which, by means of a *Memoria Technica*, we have endeavoured to afford our pupils a ready means of recollecting the bearings of cities, lakes,

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the distance between London and York as a scale to measure all the other distances. For the sources and terminations of most rivers mentioned in this work we have been indebted to Smallfield's "*Potamology, or a Tabular Description of the Principal Rivers throughout the World,*" to which we invite attention. That Table, on examination, will be found to contain outlines for a most extensive and accurate knowledge of the earth's surface. We recommend our pupils or readers to take the best Atlas they possess, and to trace in it the course of the first river described, viz. the Danube. The name of each river is associated with the country in which it takes its rise. The nearest town to its source is named, and its course is minutely described; so that by tracing it, the pupil may be impressed with a distinct view of the countries traversed or divided by it, in its numerous meanders, the bearing of each of which is specified. The large towns standing on its banks are mentioned in the order of the descent of the stream, and whether they are on the *left* or the *right* bank. The ocean, sea, or lake, into which each river falls, is stated: the chief town at or near the termination of the stream is also specified. From this detail it will be obvious that the above-mentioned Table would form a suitable accompaniment to our work, in which, by means of a *Memoria Technica*, we have endeavoured to afford our pupils a ready means of recollecting the bearings of cities, lakes,

seas, and points of the continents, &c., from one another, as well as the longitudes and latitudes of cities; nor can we omit to mention, that the tracing of rivers will enable our pupils more duly to appreciate the importance of those mountains or elevated plateaux from which rivers take their rise, or through which they wind their majestic courses.

(Since our last sheet on Africa went to press, the account of the discovery of the Niger's termination by the Messrs. Lander, has appeared in Blackwood's Magazine for July, 1831. They describe its source as being on the Eastern side of Mount Loma, in  $9^{\circ} 15'$  North latitude and  $9^{\circ} 36'$  West longitude, about 200 miles East of Sierra Leone. Under the name of the Joliba it bends its course North-east to Bamakoo; it then runs due East about 420 miles; afterwards winding the same distance North-east to Timbuctoo, and then bearing nearly South to the Gulf of Guinea, it discharges itself, by several mouths, at the Bight of Biafra. Thus have Messrs. Lander set at rest the question respecting that noble river's source and termination.)

The pupil is next exercised in calculating mentally most of the problems usually solved by the globes. Having ourselves for many years been accustomed to teach from Mr. Bourn's edition of Mr. Butler's Exercises on the Globes, we strongly recommend that valuable *treatise* to precede or accompany our problems. The merits

of that work are too well known and appreciated to need any comment from us. The following PROBLEMS are not intended by any means to supersede the Use of the Globes, but to impart the means of solving those problems, mentally, which the student has performed mechanically, and to apply what he has learned to the motions of the earth, and to the apparent motions of the heavens themselves.

Maps of the four quarters have been omitted, as most pupils are in possession of an Atlas containing maps superior to those generally to be met with in books of this size.

## ERRATA.

Page 29, line 5, for 'E. of Jutland Channel' read *W.*  
33, — 27, for 'half a day's (30 m.)' read *two days' (120 m.)*.

After p. 119, for (20) read (120).

Page 258, line 5 of the note, between 'to' and 'in' insert *be*.  
265, — 26, for 'when' read *where*.

## 6 ECLIPTIC, COLURES, EQUINOXES, SOLSTICES.

one is named the Northern and the other the Southern hemisphere. Countries are said to be North or South according to the name of the hemisphere in which they are situated.

1. Has the earth a motion ?
2. Upon what does the earth turn, and from what is the word axis derived ?
3. What are the extremities of the axis called, and why ?
4. Whence are the words arctic and antarctic derived ?
5. What is the cause of day and night ?
6. Near what star is the North Pole in the heavens ?
7. What circle divides the globe into equal parts, and why called equator ?
8. What are the parts separated by the equator called ?
9. Why are countries called Northern, and why Southern ?
10. What do you understand by hemisphere ?
11. By what motion do you measure the day ?
12. What is the measure of a day in the planets ?

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## LESSON IV.

### *Ecliptic, Colures, Equinoxes, Solstices.*

THE Ecliptic, from the Greek *eclipse* (to disappear), so called because eclipses generally take place upon or near this circle. In this circle the sun apparently performs his annual course, though in reality it is the real path of the earth round the sun : this circle cuts the equator at an angle of 23½ degrees, which obliquity is the cause of the change of the seasons. This circle in respect to the equator has

four distinct points, two upon it, and two  $23\frac{1}{2}$  degrees above and below it. Each point is the commencement of a season, and the two circles in the heavens cutting each other at right angles, and passing through the four points, are called *colures*, from the Latin *coluri*: they are two great circles which divide the seasons from each other. The one that passes through the two points of the ecliptic, where it cuts the equator, is called the equinoctial colure, and the points themselves, the vernal\* and autumnal† equinoxes.‡ The other, which passes through those parts of the ecliptic which are  $23\frac{1}{2}$  degrees above and below the equator, is called the solstitial, from *sol* the sun, and *sto* to stand, because when the sun arrives at this part of the ecliptic, it appears to stand still for several days, and then returns towards the equator, and the points themselves are called the summer and winter solstices. As the earth moves in the ecliptic to cause the difference of seasons, it follows that the earth's orbit is the measure of its year; therefore the orbits of all the planets must be the measures of their years, and as their orbits are not all equal, their years will not be all equal.

1. What is the Ecliptic, and why so called?
2. Is the Ecliptic the same as the Equator?
3. In what do they differ from each other?
4. In an angle of how many degrees does the Ecliptic cut the Equator?
5. When the sun appears upon the equator, are the days

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\* Vernal from *Ver* (Spring).

† Autumnal from *Autumnus* (Autumn).

‡ From the Latin *æquus* equal, and *nox* night: when the sun is in either of these points, the days and nights all over the world are equal.



## 8 SEASONS—SPRING, SUMMER, AUTUMN, AND WINTER.

and nights equal? And on what two days does the sun appear on it?

6. How many particular points do you observe in the Ecliptic, and what are those points called?

7. How many degrees is the Summer Solstice above the Equator, and why is it called the Summer Solstice?

8. From what words is Solstice derived?

9. What is meant by the Colures, and why are they so called?

10. Into how many parts do the Colures divide the globe?

11. What is that point of the Ecliptic called where spring begins?—where summer begins?—where autumn begins?—and where winter begins?

12. What are the circles called which separate the quadrants or seasons?

13. What is the measure of a planet's year?

14. What is the measure of the earth's year?

15. Are the years of the planets all equal?

16. What is the cause of the difference?

## LESSON V.

*Seasons — Spring, Summer, Autumn, and Winter.*

*Zones — Torrid, Temperate, and Frigid.*

THE sun appears in the heavens much higher in summer than in winter, and as this is caused by the obliquity of the ecliptic, or the path of the earth round the sun, it follows that the seasons cannot be the same to all the inhabitants of the earth at the same time of the year—because

the colures are the beginning or separation of the seasons, and the sun cannot appear the same to all the inhabitants of the earth, except on two days of the year, viz. on March 21st and September 23d—our spring and autumn. At all other times the sun will appear above the equator to the inhabitants of our hemisphere and below it to the inhabitants of the other hemisphere. The day on which the sun appears to rise above the equator to the inhabitants of either hemisphere is the day that their spring commences.

The two days on which the sun rises above the equator to the northern and southern hemispheres, are March 21st and September 23d, consequently our spring must be the opposite part of the year to the inhabitants of the southern hemisphere; likewise winter and summer are also, in opposite parts of the year, in opposite hemispheres.

Spring commences with the inhabitants north of the equator on March 21st, and it commences to the inhabitants south of the equator on September 23d. Our summer begins on June 21st, and theirs December 22d.

As the sun is  $23\frac{1}{2}$  degrees above the equator in summer, and  $23\frac{1}{2}$  degrees below it in winter, he must be vertical (*vertex*, top, over head) to a space of the earth's surface equal to 47 degrees. Now, as this part encompasses the earth as a girdle, it is called a zone, from *zonē* (a girdle); and since the sun is vertical over this part of the earth, it is called the *torrid zone*, from *torridus* (hot).

Since the sun attains  $23\frac{1}{2}$  degrees above the equator, so many degrees he will shine beyond the poles; consequently the inhabitants of the poles will have the sun above their horizon as many days as the sun continues above the equator. This part of the earth, where the sun shines without setting, is called the *frigid zone*, from *frigeo* (to freeze).

The spaces of 43 degrees between the torrid and frigid



are called the temperate zones, from *tempero* (to temper), since these parts of the earth have a temperature between extreme heat and extreme cold.

There are two frigid zones, two temperate, and one torrid.

The circles which separate the torrid from the temperate zones are called tropics, from *trepō* (to turn), because, when the sun arrives at these points, he appears for some days to stand still, and then to go backward; these two circles are called the *tropics of Cancer* and *Capricorn*. The circles which separate the temperate zone from the frigid are called arctic and antarctic circles.

1. Why have not the inhabitants of the earth the same seasons at the same time?
2. Where does the sun appear when our spring commences?
3. When does summer begin to the inhabitants of South America?
4. On what day does spring begin to the inhabitants of North America?
5. On what day will winter begin with the inhabitants of North America?
6. What is the cause of spring?
7. What do you mean by a zone?—from what word is it derived?—and how many zones are there?
8. Why are there two frigid zones, and why two temperate?
9. Where are the temperate zones situated, and what is their breadth, also that of the frigid zones?
10. To what are the zones compared?
11. What do you mean by tropics, and by what names are they called?
12. How are the tropics situated with respect to the equator?

## LESSON VI.

*Quadrants, Longitude and Latitude.*

As the earth contains eight quadrants, every country upon its surface must lie upon some one or more of these quadrants. Now, to find or know the exact situation of any country or city, geographers have divided the earth into portions, by a certain number of circles, to shew its length and breadth.

The circles used to measure its length are called lines of longitude (*longitudo*, length) or meridians, so called from the sun being upon them at mid-day (*medius-dies*): these circles cut the equator at right angles and pass through the poles. The circles used to point out latitude are called parallels of latitude, because they are parallel to the equator and to each other. Every circle contains 360 degrees, consequently each quadrant contains 90 degrees. To know the longitude of any place we must have some fixed point to start from.

Geographers of different nations are not agreed as to this point. The French reckon their longitude from a *meridian* passing through Faro, one of the Canaries; but the English, on their maps and globes, make that their first meridian which passes through London or the Royal Observatory of Greenwich. To shew the application of these circles we will suppose the slate before us to represent a quadrant of the earth's surface: if we divide the slate into six divisions by six perpendicular lines, these lines will represent the circles of longitude upon a globe. Then, since each quadrant contains 90 degrees, it follows that each of these divisions or meridians will be 15 degrees from the other; as every place has a meridian, we can de-

termine its longitude by drawing another line parallel to the former, and the number of degrees marked upon the equator, cut by the meridian, will shew its longitude.

Longitude is measured from the first meridian of Greenwich, eastward and westward, upon two quadrants each way; consequently places are said to have east and west longitude according as they are situated upon the eastern or western quadrants. Places, therefore, can have 180 degrees of east or west longitude, but not more; and though we have shewn that every place must have a meridian, yet every place has not longitude.

If, again, we cut these perpendicular lines by other six lines at right angles, we then obtain six parallels of latitude, from the Latin *latus* (broad). Now geographers of all nations are agreed as to their mode of reckoning latitude, since they all reckon it from the equator towards the poles, and this on an artificial globe is reckoned upon the brazen meridian, in which the globe is suspended. Since the poles are half a great\* circle or 180 degrees from each other, if we divide this into two equal parts by the equator, it follows, that places can have no more than 90 degrees of latitude, and places situated upon the equator will have no latitude.

It will appear from what has been pointed out that latitude must be called by two names, because it is reckoned from the equator both ways towards the poles; consequently places are said to have north latitude if situated on

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\* Great circles divide the earth into two equal parts, and less circles into two unequal parts; the former being the ecliptic, equator, and colures, and the latter the tropics and parallels of latitude.



the north side of the equator, and south latitude if on the south side of the equator.

1. What are longitude and meridian, and from what is the latter derived?
2. Into how many divisions of longitude is a quadrant usually divided?
3. How many degrees does a quadrant contain?
4. How many miles make a degree of longitude upon the equator, and does it vary in different parallels of latitude?
5. When the sun is south, what is the line passing through the sun and poles called?
6. How many degrees of longitude can a place have?
7. What places have no longitude, and how is longitude reckoned?
8. What do you mean by latitude, and do all geographers agree in their mode of reckoning it?
9. What is the greatest latitude a place can have, and what parts of the earth have no latitude?
10. How do you distinguish places in respect to the equator?

*Observation.* The pupil should now be exercised in the various questions arising out of this and former lessons, till the circles of the sphere are fully understood and their relative distances from each other known; after which, particular places may be marked upon a slate and their latitude and longitude nearly determined when viewed in relation to these circles; a knowledge of which is of great importance when it is considered that by them the various climates of the earth are determined, and principally the grand characteristic features of the animal and vegetable kingdoms are ascertained.

## LESSON VII.

*The Great Physical Divisions of the Earth.*

## LAND AND WATER.

The natural divisions of Land:

Continents

Isthmuses

Islands

Promontories

Peninsulas

Mountains.

The natural divisions of Water:

Oceans

Straits

Seas

Lakes

Gulfs

Rivers.

1. A Continent (Latin *continens*) is a large and spacious tract of land, comprehending many countries or kingdoms, and states, and uniting them together without any separation of its parts.

2. An Island or Isle is land entirely surrounded by water, as Great Britain, &c.

3. A Peninsula (Latin *pene insula*), sometimes called Chersonesus, is a part of land every way surrounded by water, except a narrow neck which unites it to a continent.

4. An Isthmus, from the Greek *eiseimi* (to enter), is a narrow neck of land uniting a peninsula to a continent, by which we enter from one to the other.

5. A Promontory (Lat. *Mons in mare prominens*) is a high point of land stretching itself into the sea, the extremity of which is called a *cape*; a *point* when elevated; if less elevated and small, a headland or naze.

6. A Mountain (from the Fr. *montagne*) is a rising part of land, overtopping the adjacent country, and appearing the first at a distance.



Mountains are among the finest and most useful features of the globe. Nothing surpasses the grandeur of an extensive range of majestic mountains which seem to predominate over the rest of the world, while their summits, topped with perpetual snow, rise above the clouds. In mountains are found the sources of rivers; hence mountainous districts generally have numerous streams, whose courses are determined by the mountain ranges.

7. The Ocean is a grand collection of water, surrounding a considerable part of the earth, but, in its most extensive sense, it means the water which encompasses the *whole* earth: geographers divide it into portions, as the Pacific and Atlantic oceans.

8. The Sea (Lat. *salum*) is a small collection of water interspersed with islands, and sometimes entirely surrounded by land, as the Caspian sea.

A Gulf, from the Greek *colpos*, is a part of the sea running up into the land, and sometimes surrounded by it, except a narrow neck or strait forming a communication with the neighbouring sea or ocean.

9. A Strait (Lat. *Fretum*) is a narrow passage either joining a gulf to the neighbouring sea or ocean, or one part of the sea or ocean to another.

10. A Lake,\* from the Greek *lacos*, is a smaller collec-

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\* Lakes are reservoirs of water among mountains, therefore the more elevated countries abound more in lakes. Rivers feed lakes, and carry off their superfluous waters. Wener, the largest of the Swedish lakes, receives more than 20 rivers, and the river Gotha discharges its waters into the sea. The Rhine both feeds and discharges Lake Constance with part of its waters. The Dead Sea in Palestine has no outlet. The water poured into lakes without outlets (if not salt) corrupts, and by a separation

tion of water, sometimes entirely surrounded by land, and sometimes connected with the ocean by rivers.

1. Which are the great divisions of the earth?

2. What are the natural divisions of land?—and also those of water?

3. What do you mean by a continent, a peninsula, an island, and a promontory?

4. From what are these words derived?

5. What do you understand by sea, gulf, and ocean?

6. What pieces of water compare with a continent?—an island?—a peninsula?

7. What is the difference between a continent and an ocean, and in what respects are they the same?

8. Say in what respects the natural divisions of land are the same as those of water.

## LESSON VIII.

### *Vegetation as depending upon the Zones.*

THE functions essential to the life of vegetables are performed chiefly on the surface of plants; hence their great dependence upon the medium by which they are surrounded; and as the sun is the source of light and heat, and life

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of its component parts, forms deposits of salt. The largest salt lake in the world is the Caspian Sea, into which run the rivers Oural, Terek, Yemba, Volga, and others, and as there is no outlet, its waters are salt.

A river (Lat. *flumen* vel *fluvius*, from *fluo* to flow) is a considerable stream of fresh water issuing out of one or more fountains, and gliding in one or more channels till at length it empties itself into the sea.

being supported by these, the *tropical climates* will be found to abound more in juicy fruits, pungent aromatics, vegetation in more perfect maturity, stateliness, and splendour, than in climates within the temperate and frigid zones. Thus we observe in each climate vegetation adapted to its soil, and the atmosphere by which it is surrounded. The powerful beams of the sun raise the plant into a shrub, and the shrub into a tree: the sap which in other regions merely flows in the veins of vegetables, in the tropics ripens and exudes through the stem under the form of gums and juices, which either form remedies against diseases, or please the appetite of the luxurious.

In the tropics are found the sugar-cane, palms, bread-tree, pisang or Java fig, the coffee tree, the date, the cocoa and vanilla, and the immense boabab, or giant of vegetation: this is the garden in which flourish the cinnamon, the nutmeg, and camphor tree, and various kinds of coloured woods, among which is calamba, sold for its weight in gold, and woods used in dying. The Banyan or Indian fig-tree attains to a great size, and sometimes covers such a space of ground as to admit one thousand persons to rest beneath its shady branches. Corn, such as the holcas, durra, and cambia, is not so fine as that produced in temperate climates.

Vegetation in the temperate zones may be divided into two parts, but the limits of these demi-zones must vary from the 40th to the 50th parallels: this variation depends upon a local climate. On the boundary of the temperate and frigid zones commence the pine and fir, covered with perpetual verdure. Fruit trees, the apple, pear, cherry, and plum, are cultivated in the north of the North temperate zone, and hemp and flax are indigenous to it. The more delicate fruits, such as the olive, lemon, orange, and fig tree,



as well as the cedar, cypress, and cork, belong to the southern part of the North temperate zone.

The vine and mulberry occupy a space between the 30th and 50th parallels, and in France, Germany, and Hungary, they flourish beyond the parallel of 50°. The country of the vine is southward of the 45th parallel.

Peaches, apricots, almonds, quinces, chesnuts, and nuts, disappear as we approach either of the tropics or arctic regions.

Wheat, rye, millet, and buckwheat, flourish the most between the 40th and 60th parallels, but south of the North temperate zone, rice and maize.

Vegetation in the frigid zone is short and stunted, and confined to a few species. The birch and willow are seen near the north borders of the temperate zone, then ferns, creeping shrubs, and bushes, with small berries, and lastly, nothing but lichens and mosses, the latter of which is the chief food of the rein-deer.

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#### LESSON IX.

#### *The Diversity of Colour and Figure of the Human Race, and Varieties of the Human Species.*

BEFORE we pass through the continents of Europe, Asia, Africa, and America, we will take a short view of the diversities of the colour, figure, and stature of the people who compose the different nations of the earth; and as this diversity depends partly upon the food and mode of living, we shall only in this place observe the most striking difference in the human species, and those places of the

earth in which this difference may be supposed always to prevail.

Under the equator, where the heat is excessive and almost insupportable, the inhabitants are completely black, of middle stature, and naturally languid. As we pass from the equator across the torrid zone towards the tropics, the natives become less black, and their strength of body greater.

In the temperate zones the natives are of a fair and delicate white complexion, strong and well proportioned, and naturally of a gay and animated disposition. The inhabitants of the temperate zones are taken as the standard of beauty and elegance of form. Yet the natives of these temperate climes admit of great diversity of colour or shades of complexion, according as they are more or less distant from the tropics and the arctic circles. The inhabitants near the tropics are of an olive or brown colour, whilst those who dwell near the arctic regions are of a tawny hue.

The natives of the frigid zones, being subject to protracted cold and rigorous seasons, are seldom more than four feet high : their growth, like all animated nature around them, is contracted, their appearance is uncouth, and their countenances naturally appear ferocious.

The farther we travel northward, the less prodigal is nature in her gifts, and the human race in those parts is the most degraded of her species in form, intellect, and civilization, being little above the brutes.

*There are five principal types or models of the human species : viz. 1st, the Caucasian race, which inhabits the central parts of the old continent, viz. Western Asia, Eastern and Northern Africa, Hindostan and Europe.*

*2nd. The Eastern race or variety of the old continent comprises all the Asiatics to the East of the Ganges and*



Mount Beloor, except the Malays. In this variety are Laplanders and Samoiedes.

3rd. The American variety in many respects resembles the Eastern variety; its principal character is a copper or red colour.

4th. The Malay race are of a tawny hue, hair abundant, black, thick, soft, and curled. This variety comprehends the islands of the Pacific, Marian, Philippine, Malacca, Sunda Island, and the indigenous inhabitants of the Peninsula of Malacca.

5th. The Negro variety are spread over all Western and Southern Africa, on the coasts of Madagascar, the great island of Van Diemens, in New Caledonia, and New Guinea. This race is completely black, with woolly, black, and curled hair.

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## LESSON X.

### *Marine Animals.*

ZOOPHYTES are imperfectly known, so that we cannot say whether maritime regions possess any species peculiar to themselves.

Coral, externally an animal, and internally a rock, madrepores and millepores, which, on the contrary, have a strong covering, seem to exist only in the regions adjoining the tropics.

We observe that there are four great seas of coral on the globe; first, that part of the ocean where we find flat islands, such as the Friendly Islands, New Caledonia and Solomon's Isles: the seas in which these beds of coral abound, prove very dangerous to mariners, especially as the

coral shoots perpendicularly up to an immense height. The second region of coral extends from the coast of Malabar to those of Madagascar and Zanguebar. The Mediterranean Sea is the third region, but the coral of this sea is different from the coarse substance of the South, being in great request on account of its value.

The gulfs of Arabia and Persia are peopled with submarine forests of Zoophytes.

The ocean contains monsters which it is dangerous to examine too nearly : this has given rise to various opinions among moderns, as well as among the ancients, as respects the magnitude of the Polypi, which seem to vary according to the depth of the seas. In the Straits of Messina and the English Channel some have been observed with arms ten feet long, and it has been stated that there are polypi in the Mediterranean and Atlantic, whose arms have been measured thirty and forty feet in length. This may account for the krakans of Norway. Zoophytes exhibit the first actings of creative power.

The inactivity of fishes renders it possible that every basin of the ocean has its tribes : the cod,\* which are distributed over the northern seas, congregate on the banks of Newfoundland.

Herrings are peculiar to the arctic regions, and migrate annually to the coasts of Ireland, Scotland, Norway, Denmark, Holland, and the United States.

The whale and narwal or sea unicorn inhabit the Polar regions, but the cachalot† of the equator differs from that of the frozen seas.

The dolphin and porpoise are common to the temperate

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\* A female carries in its ovary nine millions of eggs.

† Ambergris is procured from the cachalot of the equator.

climates ; the former of which was much esteemed by the ancient Greeks and Romans, as they supposed that it entertained a friendship towards mankind.

The coryphenæ and the chatædons are only met with in the torrid zone : of these there are various species, which, on account of their brilliancy, have received the name of gilt-heads. The flying and electric fishes belong to the torrid zone, though the electric gymnotus belongs exclusively to America : the trembler or the silurus electricus to the rivers of Africa. But the torpedo or cramp fish is dispersed over several seas.

The phocæ vitulinæ of the Caspian Sea, and to the Baikal and Aral lakes, are a species of otter.

The molluscæ have their peculiar seas ; and we find that the pearl oyster acquires perfection no where but in the equatorial seas.

## LESSON XI.

### *Terrestrial Animals.*

AMONG terrestrial animals, reptiles occupy the lowest rank, and they increase in proportion as they are warmed by a vertical sun.

In the warmest or tropical regions serpents roll themselves up in immense coils, and conceal a deadly sting of poison under their fangs.

Of the Lizard tribe we find the crocodiles of Africa, the gaval of the Ganges, and the different coymans of America.

Birds have their geographical laws : the condor, king of



vultures, soars above the limits of Chimborazo, and never forsakes the Cordilleras of Peru and Mexico.

The vulture, or great eagle of the Alps, makes these regions the extent of his migrations.

The various species of parroquets are common to America; cockatoos to the East Indies; the beautiful loris to the Asiatic islands S. W. of the continent; the bird of Paradise to New Guinea and the neighbouring islands.

Birds which cannot fly are peculiar to the equatorial regions: the ostrich\* to Africa and Arabia; the cassiowary to Java, the neighbouring islands, and to New Holland.

The smaller birds of the tropical climes are adorned with the most beautiful and splendid colours, and their plumage vies with the metallic brilliancy of insects.

The chief phenomenon of the temperate zones is the annual migration of swallows, storks, and cranes.

The geographical disposition of the following animals baffles all attempts of classification, viz. sheep, cow, goat, ass, pig, cat, in a tame state, and the fox, bear, stag, rabbit, squirrel, rat, and mouse. The dog follows man everywhere; but towards the equator, as well as towards the poles, he loses his voice and his barking becomes a growling.

The capricorn and ibex, or wild goat, inhabit the highest summits of both continents, old and new.

The horse was not known in America till transported thither by the Europeans. Of this useful animal there are three original races: the first or best proportioned came originally from Persia, Bucharra, or Asia Minor, and was common to these countries. The Tartar horse preserves its original form, but those of England, Denmark, and Nor-

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\* The touyon or ostrich of Brazil is a different species.

way, are a mixture of the Arabian race : the second, or Mongolian race, is very small, but very strong and compact, and appears to derive its origin from the Uplands of Asia : the third, or the Arabian or African race, possesses the most showy properties, is extremely swift, and vigorous, and mettlesome.

The hog was not known in America before its discovery by Columbus, and the cat is not a native of that country.

The white Polar bear inhabits all the coasts of the Frozen Sea, and frequently crosses from one country to another on a floating piece of ice. The fox and rein-deer are common to these regions.

Otters and seals are common to northern parts of the temperate zone ; and the beaver, in great numbers, in the lakes of Labrador and N. W. of North America.

The camel originally came from Bactriana, or Great Bucharia.

The numerous family of the ape tribe gambol in the forests of the tropics.

The monkey, baboon, mandrill, and jocko, are common to Africa : the ourang-outang, gibbon, and wouwou, animals most nearly resembling the human figure, are found in Java and Borneo.

The giraffe, or camel-leopard, so remarkable for its height, swan-like neck, and gentle manners, seems only to belong to central Africa, South of Cape Guardafui : this region is also the native place of two sorts of asses, the zebra and the quaggi, and the wild boar of the greatest strength.

The two sorts of rhinoceros has each its own country : that with two horns inhabits Southern Africa, and the other with one horn is found in the East Indies and China.



The elephant of India and China is greater than that of Africa.

The lion, king of beasts, is seen in his native strength and courage, in the burning plains beyond the Altas : he roams in places least frequented by man, and is found in the deserts of Arabia and Mesopotamia, as far as Bagdad ; in the mountains of Hindostan, on the coast of Malabar, in the Ghauts of India, the islands of Sunda, and the kingdom of Siam.

The tiger acquires the greatest strength, size, and ferocity, in Bengal, Malabar, Siam, Pegu, Ceylon, and Sumatra.

The panther, leopard, and ounce, roam in the wilds of Africa.

MNEMONICS.

The great help and use of Mnemonics have been appreciated by the learned in all ages of literature, not only by the moderns, but also by the ancients ; the use of them was strongly urged by Quintilian, Cicero, Simonides, (the supposed inventor,) and many others.

Dr. Priestley observes, " I think all persons of a liberal education inexcusable who will not take the small pains necessary to make themselves masters of an artificial memory, or who think any thing mean and unworthy of their notice, which is so useful and convenient."

Numbers have been compared to grains of sand, which will not cohere in the order in which we place them ; but by transmuting figures into letters, which easily cohere in every combination, we fix and retain numbers with the same certainty as words.

Dr. Grey, in his system of Mnemonics, has used vowels as well as consonants to represent numbers: it will generally be found that the vowels, instead of assisting, rather confuse, in the formation of proper words, and mostly produce them without meaning. In the following pages, where we have recourse to words to represent numbers, we shall adopt the use of consonants only, and apply the vowels merely to assist in the combinations of letters, to form suitable and grammatical words, according to the following scale :

1	2	3	4	5	6	7	8	9	0
Q	N	M	Z	J	D	C	B	F	S
T	H	G	R	L	V	K	W	P	X

S represents 100: th 1000: and when these are combined with other letters they have the powers assigned in the scale.

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## PART II.

### LESSON I.

*Europe: Situation; Area; Population; Length and Breadth; Peninsulas.*

Europe, though least in extent of the five great portions of the world, is much more interesting and important than any of the others. Europeans, possessing the advantage of the wisdom and experience of the ancients, handed down to them from Asia and Africa, have greatly surpassed them

in the cultivation of the arts and sciences : they are more celebrated for their spirit of enterprise, and greatly excel the Asiatics, Africans, and Americans, in physical powers and intelligence of mind.

The climate of Europe, though in some countries variable, is temperate, and her soil is abundantly fertile, being well watered with many noble and majestic rivers : these have their sources, particularly in the North and South of Europe, in lofty mountains, which divide the earth into plains and valleys, and greatly diversify and adorn the face of the country.

Nearly the whole of Europe is situated on the North-west portion of the first quadrant of East longitude and North latitude ; and if we divide the temperate zone into three parts, the chief of the European states are situated upon the middle and north portions.

The superficial area of Europe, or the number of square miles its surface contains, is, MY NATIVE LAND, 3,216,526.

The population of Europe was formerly under the spiritual government of a " NUNCIO, A POPE'S LEGATE," 227,990,531.

Europe is situated between 10 degrees West and 64 degrees East longitude ; and between 36 degrees and 72 degrees North latitude.

Europe is bounded on the East by the Ural mountains ; on the North by the Arctic Ocean ; on the West by the Atlantic Ocean ; and on the South by the Mediterranean, the Sea of Marmora, and the Sea of Asoph : the former of which separates Europe from Africa, and the two latter from Asia.

The length of Europe, from the rock of Lisbon to the Uralian mountains, we go MANY WAYS, 3280.

## 28 ISLANDS, SEAS, GULFS, STRAITS, AND CAPES.

The breadth of Europe, from Gibraltar to the North Cape, is mountainous, therefore not UNVARIED, 2646.

The coasts of Europe are indented and very irregular, and in some places the sea penetrates far inland, forming many peninsulas, the chief of which are,

### *In the North of Europe.*

1. Scandinavia, QUITTING, 1123 m. the N. Cape.
2. Jutland, NEARLY 245 m. N. of the Elbe.

### *In the South of Europe.*

1. Spain and Portugal, LEADS 560 m. N. to S.
2. Italy extends a distance VAST 601 m. S. E.
3. Greece, including the Morea, GAINS 320 m. N. to S.
4. Crimea, Black Sea, as you TURN 142 m. N. to S.

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## LESSON II.

### *Islands, Seas, Gulfs, Straits, and Capes.*

THE breadth of the continent is, between the Caspian Sea and the Arctic Ocean, travellers TELL US, 1550 m. ; the Ural chain EXTENDS 1260 m. between the two seas.

The Arctic Ocean BEARS 840 m. from the Ural chain to the N. Cape : in the middle of this coast is the Gulf, called the White Sea, which penetrates MILES 350 inland.

### *Islands in the Arctic Ocean, 4.*

1. Nova Zembla N. WAYS 80 m. of the Ural chain.
2. Spitzbergen RUNS 420 m. N. of N. Cape.
3. Colgou, as you TURN 142 m. N. E. of Lapland.
4. Luffoden Isles, N. W. coast of Norway.

QUITTING 1123 m., the N. Cape N. W. in the Atlantic, we arrive at the Shetland Isles, and at the Naze or South Cape of Norway, the entrance into the North Sea or German Ocean.

Edinburgh LEADS 560 m. E. of Jutland channel, called by the English and Dutch the Sleeve: this channel lies E. WAYS 80 m. between Norway and Jutland, and enters another channel between Norway and Sweden, called the Kattegat, which a direction TAKES 170 m. S.

The Kattegat terminates in three channels, viz. 1, the Sound running S. WAYS 80 m. between Sweden and Zealand: 2, the Great Belt between Zealand and Funen: 3, the Little Belt between Funen and Jutland.

The Baltic Sea RUNS 420 m. W. along the German coast, and then MILES 350 N. to the entrance of the Gulf of Finland.

The Gulf of Finland we NOTICE 217 m. E., at the top of which is Petersburg.

The Gulf of Bothnia RUNS 420 m. N.: this Gulf is half the length of the Baltic Sea from N. to S.

In the Baltic Sea are twelve islands, the chief of which form a part of the kingdom of Denmark.

- |                             |            |                             |
|-----------------------------|------------|-----------------------------|
| 1. Zealand                  | } Danish { | half a DAY's (30 m.) voyage |
| 2. Funen                    |            | E. of Jutland.              |
| 3. Laland                   |            | NEAR 24 m. W. of Zealand.   |
| 4. Bornholm                 |            | S. of ditto.                |
| 5. Oeland, <i>Swedish</i> , |            | E. WAYS 80 m. of ditto.     |
| 6. Gothland, a DAY's        |            | 60 m. voyage E. of Oeland.  |
| 7. Rugen, Prussian,         |            | TURN 142 m. N. of Berlin.   |
| 8. Usedom, ditto,           |            | S. E. of Rugen.             |



### 30 ISLANDS, SEAS, GULFS, STRAITS, AND CAPES.

9. Wallen, Prussian, E. of Usedom.
10. Osel, Russian, S. W. of Revel.
11. Dago, ditto, S. W. of ditto.
12. Aland, ditto, W. of Abo.

The Straits of Dover, at the entrance of the British channel, are a distance VAST, 601 m. from the Skagerack. The North Sea or German Ocean washes the British COAST 701 m.

In the North Sea are three islands and groups, viz.

1. Heligoland, English, mouth of the Elbe.
2. Sylt, Danish, N. WAYS 80 m. of the Elbe.
3. The Texel, Dutch, W. of Zuyder Zee.

The British channel, a direction GAINS 920 m. W. by S. of Cape Dungeness to the Lizard Point: this point the navigator STATES 110 m. N. of Brest, in France. In the British channel are five islands, viz.

1. Isle of Wight, off Portsmouth, N. WAYS 80 m. of Cape La Hogue, in France.
2. Alderney, *English*, 'Tis 10 m. W. of C. La Hogue.
3. Guernsey, *ditto*, NEAR 24 m. S. by W. of Alderney.
4. Jersey, *ditto*, NEAR 24 m. S. E. of Guernsey.
5. Sark, *ditto*, between the two last islands.

These four islands, off the coast of France, are the only remains in possession of the British crown of William the Conqueror's inheritance and Dukedom of Normandy.

To Milford Haven, in Wales, one QUITS 110 m. to the Land's End, across the Bristol channel: in this channel is Lundy Island, off Hartland Point. Milford is a DAY'S (60 m.) voyage across St. George's channel to Wexford, in Ireland. St. George's channel, between England and Ireland, extends NEARLY 245 m. from S. to N. to Fair Head,

## ISLANDS, SEAS, GULFS, STRAITS, AND CAPES. 31

N. E. of Ireland : this point is half a DAY's (30 m.) voyage from Mull Cantire, in Scotland.

In St. George's channel are two islands, viz.

1. Anglesea, E. WAYS 80 m. of Dublin.

2. Isle of Man, N. W. WAYS 80 m. of Liverpool.

### LESSON III.

#### *Continuation of the last Lesson.*

CAPE CLEAR, the S. point of Ireland, VARIES 640 m. N. of Cape Finisterre, in Spain.

The Bay of Biscay is seen MILES (350) E. of Cape Finisterre.

From Cape Finisterre, which is N. WAYS 80 m. of Oporto, the Atlantic Ocean RUNS 420 m. along the Portuguese coast to Cape St. Vincent, which we NOTICE 217 m. N. by W. of the Straits of Gibraltar.

In the Atlantic Ocean are three large islands and thirteen smaller islands and groups of islands belonging to Europe, viz.

#### *Three Large Islands.*

1. Great Britain we NOTE 21 m. W. of France.
2. Ireland, W. WAYS 80 m. of England.
3. Iceland, *Danish*, a distance VAST 601 m. N. W. of Scotland.

#### *Thirteen Small Islands and Groups, viz.*

1. The Faro or Faroe Islands, *Danish*, N. of Scotland.
2. Orcades or Orkneys N. WAY 8 m. from John O'Groats.

### 32 ISLANDS, SEAS, GULFS, STRAITS, AND CAPES.

3. Shetland Isles, as you TURN 142 m. N. by E. of Scotland.
4. Hebrides, W. of Scotland.
5. Scilly Isles, W. WAYS 80 m. of the Land's End.
6. Isle of Ushant, *French*, QUIT'S 110 m. Lizard Point off Brest.
7. Croix, S. of Ushant.
8. Belleisle, as you TURN 142 m. S. E. of ditto.
9. Noirmoitier, a DAY'S (60) m. voyage S. E. of Belleisle.
10. Oleron, as you TURN 142 m. S. E. of ditto.
11. Rhé, N. of Oleron.
12. Isle de Dieu, between Oleron and Belleisle.
13. Azores, nine in number, as we PASS 900 m. W. of Lisbon.

As we PART 941 m. E. of the Straits of Gibraltar we arrive at Cape Bon, in Africa : this Cape QUIT'S 110 m. the coast of Sicily westward.

The Mediterranean is divided into two great basins : the first basin is terminated by the Straits of Messina and Cape Bon. In this basin are three large islands, and six small islands and groups.

#### *Three Large Islands.*

1. Sicily, W. of Spartivento, in Italy.
2. Sardinia, which we NOTICE 217 m. W. of Naples.
3. Corsica, as you TURN 142 m. S. of Genoa.

Bastia, capital of Corsica, we NOTICE 217 m. N. of Cagliari, capital of Sardinia.

#### *Six Small Islands.*

1. Ivaca, half a DAY'S (30 m.) voyage E. of Cape Martin.
2. Majorca, a DAY'S (60 m.) voyage N. E. of Ivaca.
3. Minorca, NEAR 24 m. N. E. of Majorca.

These three islands belong to Spain.

4. Hieres, French, off Toulon.
5. Elba, off Tuscany, NEAR 24 m. E. of Cape Corso in Corsica.
6. Lipari Islands, N. of Sicily.

The greatest distance is in this basin of the African shores from EUROPEAN 492 m., viz. from Tunis to Genoa.

The second basin of the Mediterranean Sea washes the shores of Africa, sailors TELL US, 1550 m.; this basin is terminated on the N. by the gulfs of the Adriatic Sea and the Archipelago.

The Ionian Sea, at the entrance to the Gulf of Venice, is comprehended by three capes: Cape Leuca is MILES 350 N. W. of Cape Matapan, S. of Greece, and Cape Spartivento as you TURN 142 m. S. of Cape Leuca, in Italy. The Gulf of Tarento is seen N. W. WAYS 80 m. of Cape Leuca.

In the Ionian Sea are seven islands, called the Ionian Republic, which is under the British protection.

1. Corfu, chief island, TURNS 1420 m. S. E. of London, and from the Straits of Gibraltar, a DAY'S (60 m.) voyage more, or 1480 m.
2. Paxu, between Cephalonia and Corfu.
3. Cephalonia, NEAR (24 m.) W. of Patras, Gulf of Lepanto.
4. Zante, half a DAY'S (30 m.) S. of Cephalonia.
5. St. Maura, half a DAY'S (30 m.) sail S. E. of Corfu.
6. Teaki, N. E. of Cephalonia.
7. Cerigo, NEAR (24 m.) voyage S. E. of Cape Matapan.

In the Adriatic Sea are several islands along the Dalmatian coast, as far as Venice, which is JUST 501 m. N. W. of Cape St. Leuca.

In the Gulf of the Archipelago, or White Sea of the Turks, which MAKES 370 m. N. of Candia, are the Cyclades and Sporades; the former are a cluster of Islands S. E. of Greece, in the form of a circle, the latter extend along the coast of Asia and N. of the Gulf.

Candia, the chief island in the second basin of the Mediterranean Sea, EQUALS 150 m. in length, three times its breadth.

Malta is a DAY'S (60 m.) voyage S. of Cape Passero in Sicily.

We go N. E. WAYS 80 m. through the Dardanelles, and enter the Sea of Marmora or Propontia. The Sea of Marmora a direction TAKES 170 m. E. by N. to the Straits of Constantinople, or the Bosphorus, at the entrance of the Euxine or Black Sea.

The Peninsula of the Crimea RISES 400 m. N. E. of Constantinople as we TURN 142 m. S. W. of the Straits of Caffa, or the Cimmerian Bosphorus.

The Sea of Azoph is so called from a city of that name, which is situated NEARLY 245 m. N. E. of the Straits of Caffa.

#### LESSON IV.

##### *Chains of Mountains, their Directions and Lengths; Heights of Mountains.*

THE chief mountain chains in Europe are the Alps, from which various other branches spread over southern Europe; the Dofrine or Scandinavian mountains; and the Ural mountains.



These three chains of mountains are entirely separated from each other by a vast plain, which LEADS 560 m. from London and Paris over the peninsula of Jutland; then QUITTING 1123 m. E. of Jutland, along the shores of the Baltic Sea, it reaches Moscow; and lastly, it BEARS 840 m. S. E. of Moscow to Astrakan on the Caspian Sea.

The mountains of England, Wales, and Scotland, consist chiefly of groups and parallel branches too detached to be ranked under the denomination of chains.

*Chief Mountains of England, Scotland, and Wales.*

Helvellyn, Cumberland; below its lofty summit many	Feet.
GEESE LIVE .....	3056
Cheviot Hills, between England and Scotland. This	
chain never holds its HEAD LOW .....	2658
Plinlimmon is king of flocks and HERDS .....	2460
Snowden, Wales. Its top as white as MILK IS ....	3570
Ben Nevis, Scotland, is as lofty as ROUMELIUS' ....	4350

The Dofrine mountains are distinctly marked and well defined, steep rocks, frightful precipices, cataracts, and glaciers, excite the astonishment of the traveller. This chain extends through the whole of Norway, from the North Cape in the island of Mageroe, to the Naze, south of Norway, and WASTES (8010 ft.) on high its snowy locks. Lapland and the S. W. of Norway are crowned by separate groups.

The central range, called the Alps, are the most elevated mountains in Europe, in the centre of which stands Mount Blanc, so much TALKED OF (15,769 ft. high) by travellers: this mountain is the nucleus or kernel from which four distinct chains branch off and traverse through the principal states of Europe. The Alpine chain, which ex-

tends in the form of a crescent from Mount Ventoux, in Dauphiny in France, to Mount Kelenburg, in Austria, a distance VAST 601 m. This branch separates the basin of the Danube from that of the Po.

*Chief Mountains of the Alps.*

	Ft. high.
Mount Blanc, so much TALKED OF.....	15,769
Great St. Bernard, to clime is a TASK ABOVE....	10,786
The road across the Simplon, in the rock, was by Bonaparte DELVED.....	6,566
St. Gothard, to poets is a theme POETICAL.....	9,175
The passage across St. Gothard alarms one in VIEWING .....	6,823

The eastern branch, or Dalmatian Alps, RUNS 420 m. between the Adriatic Sea and the Danube, as far as the Despoti-Dag, or ancient Scomius, N. of Macedonia, which may be considered the centre from which four other branches extend: 1st, the Hemus or Balkan chain passes NEARLY 245 m. N. of Romania, till it reaches the Black Sea: 2nd, the Rhodope, which we NOTICE 217 m., as far as the Gulf of Contessa: 3rd, a chain which RUNS 420 m. through Greece, and known under the names of Olympus, Pindus, Oeta, Parnassus, Helicon, and Lycæus: 4th, the Albano-Dalmatian mountains, or western branch.

*Heights of Chief Mountains.*

	Feet.
Orbelus of mountains is QUITE A KING.....	11,723
The Robber on Mount Hemus no assistance CRAVES .....	7,460
Olympus, his lofty head with snow DECKS .....	6,770
On Pindus the traveller with cold BLEEDS .....	8,560

The northern range includes the Jura, as you go **THEN** 122 m. N. of Geneva to Bâle, and the Vosges at the source of the Moselle: the German or Hercynian mountains which are connected with the Vosges, and the Carpathian or Krapak mountains which join the Alps in Austria.

The Hercynian, or German branch, a direction **TAKES** 170 m. E., and then separates, inclosing the basin of Bohemia, **JUST** 501 m. in circumference; it then separates Moravia from Silesia E. **WAYS** 80. m., and **RUNS** 420 m. between Hungary and Poland; and lastly, we **NOTICE** 217 m. S. W., the continuation of the chain between Transylvania and Wallachia.

*Heights of Chief Mountains.*

	Hd. Feet.
Mount d'Or (Jura), crowned in a snow <b>ROBE</b> ....	48*
Côte d'Or (Vosges), a difficult <b>ROAD</b> .....	46
Black Forest (German Chain), the seat of an ancient warlike <b>RACE</b> .....	47
The chief of the Carpathian mountains separates the jurisdiction of the <b>POPE</b> ..	99

The Hercynian and Carpathian mountains are separated by the Danube in two places: the first in Austria, and the second between Transylvania and Wallachia: in consequence of which the bed of the river is contracted and several narrow passes formed.

The whole range of these mountains may be supposed the forepart of the Alps, whose highest summits are not more than 600 ft. They inclose immense plains, the chief of which are those of Bohemia and Transylvania.

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\* The heights of these mountains are given in hundreds of feet.

The southern chain, or the Appenines, traverse the whole of Italy, and enter the island of Sicily. We NOTICE 217 m. round the Gulf of Genoa, the Appenines, in the form of a crescent, and then for MILES (350) the chain passes along the coast of Italy till we reach E. WAYS (80 m.) of Naples; it then divides into two branches, one of which reaches Cape di Leuca, and the other we NOTICE 217 m. to Cape Spartivento.

*Burning Mountains in Europe.*

	Feet.
Etna few persons dare approach—'TIS FEARED..	10,946
Vesuvius a noise is generally MAKING .....	3,723
To the noise of Heckla people with fear LISTEN..	5,012

The western range comprises the Pyrenees which cross the Peninsula of Spain, and other branches that form a central plain from 1,000 to 15,000 ft. in elevation, upon which are placed groups of mountains and different parallel chains distinctly marked. The Pyrenees on the N., and the Alpujarras, or the Sirra Nevada, on the S., may be called the outer bulwarks of the base; the former attains to an elevation of 9,000 to 10,000 ft., and the latter of 10,000 to 11,000 ft. The Pyrenees separate France from Spain, NEARLY 245 m. from the Gulf of Lyons to the Bay of Biscay.

The intermediate branches are the Guadarama between the Castiles, the Sierra Morena N. of Andalusia, and the Estrellas of Portugal; these only attain to a height from 5,000 to 6,000 ft.



## LESSON V.

*Chief Valleys; Elevated Plains; Plains; Basins; Amphitheatres; Rivers, and their lengths; and Lakes in Europe.*

THE different chains and groups of mountains and other inequalities of the earth's surface give rise to various terms used in geography, to enable us to describe and make others comprehend the physical features of a country; the following terms, of rare occurrence in elementary works of geography, it will be proper in this place to explain.

When a country is situated between parallel chains of mountains, we distinguish it by the name of *valley* or *plateau*; we call it the former when the country which separates the chains is deep and sloping, and for the most part containing the bed of a river; we denominate it the latter when the intermediate country is little below the elevated parts of the mountains supporting its base. In plateaux there are frequently valleys, but at a great elevation above the level of the sea, and rivers and lakes without an outlet, as upland plains, and table lands, are frequently called plateaux.

*Terraces* are applied to ridges of mountains less elevated, one rising above another, like so many platforms.

*Basin* is a term applied to a country surrounded, or nearly so, by mountains: it is also made use of to represent the whole of a country which supplies a river with its tributary streams, as the Basin of Bohemia, and the Basin of the Po, comprehending Lombardy and Venice. Basin is frequently applied to different parts of the ocean when nearly surrounded by islands, continents, or marine rocks, as the Mediterranean west and east of Sicily, and the Basin of the Black Sea.

*Amphitheatre* is a term used to represent a country surrounded on three sides by mountains, as Thessaly, Macedonia, and Thrace.

*Steppe* is an immense plain, such as the Steppes of the Don Cossacks of southern Russia, and the Kirguises north of Lake Aral.

The bearings of the principal mountain chains point out the direction of their rivers, as the Danube to the great Alpine chain, the Brahmapootra to the Himalah chain, and the Mekong to the Cochin China and Siamese mountains, running parallel to them and between them.

*Valleys :*

1. The Valley of the Danube.
2. The Valley of the Po.
3. The Valley of the Rhine.
4. The Valley of the Rhone.

*Elevated Plains :*

Switzerland, Bavaria, and the Waldaic Heights or Central Russia.

*Basins :*

Bohemia\* and Transylvania.

*Amphitheatres :*

Macedonia and Thessaly.

RIVERS.

*Rivers that enter the Arctic Ocean.*

1. Petzora, whose waters ROLL 455 m. N. W. from the Ural Chain.

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\* Bohemia is the physical centre of Europe.

2. Dwina, source in the Waldaic Heights, enters the White or COLD (756 m.) Sea.

*Rivers that enter the North Sea or German Ocean.*

1. Tay, Scotland, does not run FAR ..... 94 m.
2. Trent and Humber, England..... 185
3. Thames, England ..... 185\*
4. Elbe, source Bohemia, in Small DIKES .. 670
5. Rhine, source Central Alps, course N.WEST. 801

*Rivers that enter the Baltic Sea:*

1. Oder, source Silesia, whose waters ROLL 455 m. to the Baltic Sea.
2. Vistula, source Galicia, VARIES 640 m. N. E.
3. Niemen, source Central Russia, RUNS 420 m. N. W.

*Rivers that enter the British Channel.*

- Seine, France, RISES 400 m. E. of the British Channel.  
 Severn, England, whose source we NOTICE 217 m. N.,  
 at the foot of Plinlimmon, Montgomeryshire.

*Rivers that enter the Atlantic Ocean.*

- |  | Miles. |
|--|--------|
| 1. Loire, source Languedoc, of France the chief<br>or LORD ..... | 546    |
| 2. Garonne, enters the Bay of Biscay, MIND ..                    | 326    |
| 3. Shannon, Ireland, much NOTED .....                            | 216    |
| 4. Douro, source Castile, Spain, RISES .....                     | 400 E. |
| 5. Tagus, source ditto, LEADS .....                              | 560 W. |
| 6. Guadiana, source Sierra Morena, not LAST ..                   | 501    |
| 7. Guadalquiver, source ditto, less than the REST                | 401    |

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\* The lengths of these two rivers, according to a geographical TABLE, are the same.

*Rivers that enter the 1st Basin of the Mediterranean Sea.*

1. Ebro, source Pyrenees, a course **MAKES** 370 m. E.
2. Arno, Tuscany, from the Appenines is **TOST** 101
3. Tiber, States of the Church, source Appen-  
nine, **TABLE** . . . . . 185

*Rivers that enter the 2nd Basin of the Mediterranean Sea.*

1. Po, source Mount Viso, Alps, **RUNS** 420 m. into the Adriatic Sea.
2. Peneus, Thessaly, not **FAR** 94 m. from the Archipelago.
3. Strymon, Macedonia, its source **TAKES** 170 m. from the sea.
4. Marabræ, or Hebris, Romania, source Mount Hemus, **NEARLY** 245 m. N. W.

*Rivers that enter the Black Sea.*

1. Danube, source Black Forest, Swabia, according to geographical **TABLES** 1850 m. W.
2. The Dniester, between Moldavia and Russia, **CUTS** 710 m.
3. Dnieper, **QUITTING** 1123 m. Central Russia, enters the Black Sea **E. WAYS**, 80 m. of the Dniester.

*Rivers that enter the Sea of Azoph.*

Don, has its source in Central Russia, there is not **QUESTION**, 1012 m. N. of Asoph.

*Rivers that enter the Caspian Sea.*

1. Wolga, source Waldaic Heights, waters many **NATIONS** 2120 m.
2. Ural, or Jaik, from the Uralian Mountains, itself **TOSSES** 1000 m.

## TABLE.

*The Chief Countries, Kingdoms, and States of Europe are  
Thirty-eight.*

	Capital.
1. England . . .	London.
2. Scotland . . .	Edinburgh.
3. Ireland . . .	Dublin.
4. France . . .	Paris.
5. Belgium . . .	Brussels.
6. Holland . . .	Amsterdam.
7. Denmark . . .	Copenhagen.
8. Sweden . . .	Stockholm.
9. Norway . . .	Christiana.
10. Finland . . .	Abo.
11. Lapland . . .	Tornea.
12. Russia . . .	St. Petersburg.
13. Poland . . .	Warsaw.
14. Prussia . . .	Berlin.
15. Hanover . . .	Hanover.
16. Wirtemberg . . .	Stutgard.
17. Bavaria . . .	Munich.
18. Austria . . .	Vienna.
19. Bohemia . . .	Prague.
20. Saxony . . .	Dresden.
21. Hungary . . .	Buda.
22. Illyria . . .	Trieste.
23. Dalmatia . . .	Ragusa.
24. Tyrol . . .	Inspruck.
25. Lombardy and Venice .	Milan and Venice
26. Piedmont . . .	Turin.
27. Savoy . . .	Chamberri.
28. Switzerland . . .	Berne.



29. Spain	.	.	.	Madrid.
30. Portugal	.	.	.	Lisbon.
31. Tuscany	.	.	.	Florence.
32. States of the Church	.	.	.	Rome.
33. Naples	.	.	.	Naples.
34. Sardinia	.	.	.	Cagliari.
35. Sicily	.	.	.	Palermo.
36. Greece	.	.	.	Athens.
37. Turkey	.	.	.	Constantinople.
38. Ionian Republic	.	.	.	Corfu.

## LESSON VI.

*Bearings; Distances of Cities; their Longitude and Latitude.*

LONDON is situated on the first meridian, lat.  $51\frac{1}{2}$  deg.

York, second city in England, a direction TAKES \* 170 m. N. by W. of London, half way to Edinburgh.

Edinburgh was the residence of a king long AGO, 3 deg. W. long.

Holy Head, Anglesea, in Wales, is NEARLY 245 m. N. W. of London, and direct E. WAYS 80 m. of Dublin.

Dublin is situated in a beautiful CLIME,† 7 deg. W long. 53 deg. lat.

Paris we NOTICE 217 m. S. E. of London, and Amsterdam 217 m. E. by N.

Paris is the second city IN EUROPE, 2 deg., 49 deg.‡

\* The word preceding the bearing of a city shews its distance from another city in miles.

† When a remark relating to a city is made, the technical word in small capitals gives the latitude or longitude.

‡ The longitude and latitude of places when expressed in this

In Europe a Dutchman is the most SULLEN, 5 deg. 52 deg.

Brussels a direction TAKES 170 m. N. E. of Paris, THEN 122 m. from Amsterdam.

Copenhagen RISES 400 m. N. E. of Amsterdam, and LEADS 560 m. E. of Edinburgh. The long. of the capital of Denmark we mark in TIME 13 deg.

GOING N. E. 323 m. of Copenhagen, we arrive at Stockholm, and N. by W. at Christiana.

The peasants of Sweden are poor, their whole stock (Stockholm) seems only TO BE LIFE, 18 deg. 59 deg.

Christiana is NEARLY 245 m. W. of Stockholm, as you TURN 142 m. E. of Bergen, the ancient capital of Norway.

The Norwegians were famous for their chivalrous DEEDS, 6 deg. 60 deg.

Abo, a direction TAKES 170 m. E. by N. of Stockholm.

Tornea RISES 400 m. N. of Abo, NEAR (24 deg.) the Arctic circle.

St. Petersburg RUNS 420 m. E. by N. of Stockholm.

Peter the Great, the founder of St. Petersburg was much celebrated in past AGES, 30 deg. long.

Moscow, the ancient capital of Moscovia, RISES 400 m. S. E., and Archangel 400. N. E., of Petersburg.

This city is E. of Edinburgh, and S. E. WAY 8 deg. of St. Petersburg.

Warsaw VARIES 640 m. W. by S. of Moscow, a distance VAST 601 m. S. W. of Petersburg. Warsaw, once the capital of a kingdom of NOTE, 21 deg.

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manner, (viz. 2 deg. 49 deg., or 5 deg. and 52 deg.) shew that the longitude is 2 deg. and latitude 49 deg., or 5 deg. long. and 52 deg. lat., as the longitude is always first given.

*Remarks.*

England was known to the ancient Phœnicians under the name of *Barat-Anac*, which signifies the land of tin or lead; hence it is supposed that the name Britain is derived from this word: this country was also called *Albion* (*albus white*), because of its white cliffs.

Julius Cæsar invaded Britain in the year 55 B. C., and the Romans retained possession of it till the year 448\* A. D.

In the year 450,† the Saxons came over to this country, being invited by the Britons to assist them against the incursions of the Picts and Scots, obtained possession of the kingdom through treachery, and afterwards founded the Saxon heptarchy.

Scotland, ancient Caledonia, derived its present name from an ancient people called Scoti.

Ireland was called Hibernia from its ancient inhabitants the Hiberni: it is sometimes called Erinland, which in the Irish tongue signifies Westernland. This country became tributary to England in the reign of Henry II.

Wales, the seat of the ancient Britons who fled before the Roman power, was united to England during the reign of Edward I., whose son first received the title of Prince of Wales.

France, the ancient Gaul or Gallia of the Romans, derives its present name from the Franks, a people of Franconia, a country in Germany, who established themselves in France under King Pharamond, in the year 427 A. D., though the country was not called France till the reign of Clovis I. in the year 481.

Belgium, *Gallia-Belgica* of the Romans, formed a part

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\* The Romans left the Britons in great Sorrow, 448 A. D.

† The Britons grieve still more because a Saxon RULES, 450.

of the kingdom of the Netherlands by the treaty of 1815, but during the present year it has declared itself independent, and the five Great Powers have acknowledged it as such.

Denmark was so called from the Danes, its ancient inhabitants, and marck or country: and Jutland, forming a part of the kingdom of Denmark, was the ancient *Cimbrica-Chersonesus*.

Sweden was the country of the ancient Suevi or Suones, from which circumstance it was so called.

Norway is compounded of two Teutonic words, *Nort* (North), and *wey* (way): Norway and Sweden constituted the ancient Scandinavia.

Russia derives its present name from its ancient inhabitants the Russi: it was formerly called Moscovia, of which Moscow was the capital, and hence the Russians are called Muscovites.

The Russian territories are equal in extent to one half of Europe, and the population consists of Laps, Fins, Tartars, Kalmucs, and Slavonians.

Russia, properly so called, comprehends four ancient kingdoms, three Tartar and one Finnish.

#### *Tartar Kingdoms.*

1. Little Tartary or Taurida, capital Simferpol,  
QUITTING 1123 S. E. of St. Petersburg.
2. Astrakan, capital Astrakan.  
This city TENDS 1260 m. S. E. of Petersburg.
3. Casan, capital Casan or Kasan.  
Petersburgh is WEST 801 m. by N. of Casan.

#### *Finnish Kingdom.*

Permia, capital Permia or Czerdyn,  
St. Petersburg is WEST 801 m. of this city.  
Poland, a considerable part of ancient Sarmatia, forms a

part of the vast empire of Russia: it was so called from Polu or Pole, which, in the Slavonian language, signifies plain or champaign country.

Cracow, a Republic under the protection of Russia, TAKES 170 m. S. by W. of Warsaw, half way to Buda.

## LESSON VII.

### *Bearings and Distances of Cities—their Longitude and Latitude.*

GERMANY, ancient Germania, at present comprehends the following principal States, viz. one empire and five kingdoms.

Empire\* Austria, capital Vienna.

#### *Kingdoms.*

- |                 |                   |
|-----------------|-------------------|
| 1. Prussia . .  | capital, Berlin.† |
| 2. Hanover . .  | Hanover.          |
| 3. Wirtemberg . | Stutgard.         |
| 4. Bavaria . .  | Munich.           |
| 5. Saxony . .   | Dresden.          |

Berlin GETS 310 m. W. of Warsaw as we TURN 142 m. E. of Hanover, a city that we NOTICE 217 m. E. of Amsterdam.

Berlin has been the capital of a kingdom a long TIME, 13 deg. long. On Hanover's throne the King of England SITS, 10 deg. E. long.

Stutgard is NEARLY 245 m. S. by W. of Hanover.

\* Bohemia and the Grand Duchy of Austria are the only countries of the Austrian empire that belong to Germany.

† Berlin is the residence of the King of Prussia and his court; but Kouingsburg is the principal place of trade, being situated on the Pregel, near the Baltic.



Buonaparte made the Duchy of Wirtemberg into a kingdom, and which is now of the German confederation a PROP, 9 deg. 49 deg.

We TURN 142 m. E. by S. of Stutgard to Munich, a city NEARLY 245 m. W. of Vienna.

Prague, capital of Bohemia, a direction TAKES 170 m. N. W. of Vienna, and S. by E. WAYS 80 m. of Dresden.

Berlin is no distance GREAT, 341 m. S. W., of Vienna.

Besides Bohemia and the Grand Duchy of Austria, the Austrian empire comprehends

The kingdom of Hungary . . capital, Buda.

The kingdom of Dalmatia . . . Ragusa.

The country of Tyrol . . . Inspruck.

The kingdom of Lombardy } chief { Milan,  
and Venice . . . . } cities { Venice.

The kingdom of Illyria . . . capital, Trieste.

Presburg, the second city in Hungary, is on the ROAD 46 m. E. by N. of Vienna, and S. W. WAYS 80 m. of Buda.

Note (2 deg. 1 deg.) difference of longitude and latitude between Vienna and Buda.

Ragusa RISES 400 m. E. by S. of Vienna.

Ragusa stands on a rock very STEEP 19 deg. long.

Inspruck is S. WAYS 80 m. of Munich.

Milan RISES 400 m. S. W. of Vienna, and TAKES 170 m. W. by N. of Venice.

Milan is called the PROUD, 9 deg. 46 deg.

Venice, of the Adriatic, was formerly called the QUEEN ROYAL, 12 deg. 45 deg.

Trieste we NOTICE 217 m. S. by W. of Vienna, not FAR, 94 m. E. by N. of Venice.

BEAR 84 m. S. W. of Milan for Turin, as you TURN 142 m. S. by E. of Berne.

Madrid VARIES 640 m. S. W. of Turin, and S. by W. of Paris.

Madrid is called the GREAT, 3 deg. 41 deg.

Lisbon GAINS 320 m. W. by S. of Madrid.

In Lisbon, Don Miguel, the Usurper, lives in POMP, 9 deg. 39 deg.

## REMARKS.

The German confederation consists of several powers, over which the Emperor of Austria is supreme head. The principal of these powers are the King of Prussia; the King of England as King of Hanover; the King of Wirtemberg; the King of Bavaria; the King of Saxony; the King of Holland, as Duke of Luxembourg; the King of Denmark, as Duke of Holstein and Lauenberg; the Grand Duke of Hesse-Darmstadt; the Grand Duke of Saxe-Weimer; the Elector of Hesse-Cassel; besides these are nine dukes and princes representing Ducal Saxony, and eighteen more other territories of Germany, and the four free cities, Ham-burgh, Bremen, Lubeck, and Frankfort.

The Grand Duchy of Austria comprehends part of ancient Noricum and Pannonia; the districts about Vienna were included in Pannonia, and the left of the Danube in Noricum.

Austria is supposed to derive its present name from Oestereich, or Eastern kingdom, being so denominated at one period of history.

Hungary,\* comprehending the greatest part of ancient Pannonia, was so called from the Huns, a people of Asia.

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\* The Hungarian Diet claims as part of the ancient kingdom of Hungary, the provinces of Transylvania, Slavonia, and Croatia.

The kingdom of Illyria comprehends the ancient Illyricum.

The country of Tyrol is known in ancient history as the country of the Rhætii.

Switzerland, the ancient Helvetia, forms a Republic of twenty-two provinces, though the province of Neufchatel, in which is Mount Jura, is a principality subject to the King of Prussia.

Spain, the ancient Iberia, from Iberus, the Ebro, one of its rivers, and also Hesperia, because situated in the West of Europe, was divided in the time of the Romans into three provinces, viz.

1. Tarraconensis, capital, Tarracon (Tarragona).
2. Bætica . . . Gades (Cadiz).
3. Lusitania . . . Augusta Emerita (Merida).

The third Roman province at present forms the kingdom of Portugal.

## LESSON VIII.

*Bearings and Distances of Cities—their Longitude and Latitude.*

### *Italy.*

ITALY at present comprehends 4 kingdoms, 1 Arch-Duchy, 5 Duchies and Principalities, and 1 Republic,\* viz.

1. The States of the Church . . capital, Rome.

\* The Republic of St. Marino, under the protection of the Pope, is situated on the Adriatic Sea, as you TURN 142 m. N. of Rome.

- |                                 |          |             |
|---------------------------------|----------|-------------|
| 2. The kingdom of Naples or the | chief    | { Naples,   |
| two Sicilies . . . . .          | cities   | { Palermo.  |
| 3. The kingdom of Sardinia and  | chief    | { Cagliari, |
| Piedmont . . . . .              | cities   | { Turin.    |
| 4. The kingdom of Lombardy      | chief    | { Milan,    |
| and Venice . . . . .            | cities   | { Venice.   |
| The Arch-Duchy of Tuscany,      | capital, | Florence.   |
| The Duchy of Modena . .         |          | Modena.     |
| The Duchy of Parma . .          |          | Parma.      |
| The Duchy of Lucca . . .        |          | Lucca.      |
| The Duchy of Massa . . .        |          | Massa.      |

Rome BEARS 840 m. E. of Madrid, and the same distance S. E. of London.

Rome, the ancient capital of Italy, was built in a fine CLIME (753 B. C.) by Romulus, son of QUEEN RHEA, 12 deg. 42 deg.

Florence,\* capital of Tuscany, TAKES 170 m. N. W. of Rome, S. WAYS 80 m. of Modena.

To Naples TURN 142 m. S. E. of Rome.

The city of Naples presents the figure of an amphitheatre, one turret rising above another TURRET, 14 deg. 41 deg.

Cagliari is NEARLY 245 m. S. W. of Rome.

This city has the same longitude and latitude E. that Lisbon has W.

Chamberri, capital of Savoy, a province of the kingdom of Sardinia and Piedmont, is not FAR, 94 m. N. W., of Turin.

Geneva, once a celebrated republic, is S. E. WAYS 80 m. of Turin.

We NOTICE 217 m. S. by W. of Naples, Palermo, capital of Sicily.

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\* Lucca is NEAR 24 m. E. of Florence, and you TAKE 17 m. N. W. of Lucca to arrive at Massa.

Athens, the ancient capital of Greece, LEADS 560 m. E. of Palermo.

Constantinople is MILES 350 N. E. of Athens.

A city better situated for commerce than Constantinople is to be found in NO PART, 29 deg. 41 deg.

*Remarks.*

Italy, the ancient Italia, was so called from Italus, one of its most ancient kings. Italy, in the time of Augustus Cæsar, was the most powerful empire in the world; and Rome was the mistress of the arts, commerce, and civilization.

The Arch-Duchy of Tuscany comprehends the ancient kingdom of Etruria. In Tuscany is spoken the purest Italian.

Genoa was anciently called Liguria.

Lombardy and Venice form a part of the Roman Cis-Alpina Gallia. Venice, which MAKES 370 m. N. of Rome, constituted, at one time, a powerful republic, greatly celebrated for its navy and its commercial enterprise.

Greece, the ancient Hellas from Hella, *rock*, was formerly divided into four provinces, viz. Macedonia, Epirus, Achaia, including Thessaly, and Peloponnesus or Morea. Epirus, Thessaly, and Macedonia, at present belong to Turkey; and Modern, Independent Greece extends from the Gulf of Arta to the Gulf of Volo, including the Morea and Livadia, a part of ancient Achaia or Hellas. Chief cities Livadia and Napoli de Romania, as you LEAVE 56 m. S. the city of Athens.

Turkey at present comprehends the ancient countries of Thrace (Romania), Macedonia, Epirus, Albania, part of Illyricum (Bosnia, Croatia), Mœsia (Bulgaria), and Dacia (Wallachia and Moldavia).



Constantinople, the ancient Byzantium, was so called from Constantine, the first Christian emperor, who made it the seat of his empire in the year 328 A. D. Mahomet II., Emperor of the Turks, took Constantinople by storm, in the year 1453,\* and since that time Constantinople has been the seat of the Ottoman empire, and her Christian temples have been converted into Mosques in honour of the false Prophet Mahomet.

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## ASIA.

### LESSON I.

ASIA, the infant cradle of the arts, commerce, and civilization, was that part of the world in which our first parents were created, and where, in after times, it pleased the *Almighty* to make himself manifest to man in the person of *Christ Jesus*.

The climate of Asia is extreme in heat and cold ; and in some places they so nearly unite as hardly to admit of a line of separation. Mantchooria may be said to be the only country that enjoys a temperate zone in Asia.

The soil of Asia varies much in quality : it abounds in the most delicious fruits and gigantic vegetation in the South, but in the interior immeasurable deserts, moving like waves of burning sand, are seen to the great dread and terror of the traveller.

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\* Mahomet made Constantinople the capital of his REALM 453.

The shores of the continent of Asia are washed on the N. by the Frozen or Arctic Ocean ; on the E. by the North Pacific Ocean, the sea of Okotsk, and the Chinese Sea ; on the S. by the Indian, Arabian, and Red Seas ; on the W. by the Mediterranean Sea, the Sea of Marmora and the Black Sea.

Continental Asia is situated between 26 and 190 deg. E. or 170 deg. W. longitude, and between 2 and 78 deg. N. latitude.

The superficial content or area of continental Asia is 12,118,000 miles, and the population 390,000,000.\*

The coasts of the continent of Asia are much indented and irregular ; on the West coast is the peninsula of Asia Minor ; on the South are the peninsula of Arabia, the peninsula of Hindostan, the peninsulas of Cochin-China and Malacca ; on the East, Corea and the peninsula of Kamtschatka.

The greatest length of Asia is as we CROSS 7400 m. from the Straits of Bab-el-mandel to Bhering's Straits.

From the Dardanelles there are three points of the continent the same distance ; one LEADING 5623 m. N. E. to Cape Lopatka in Kamtschatka, another LEADING 5623 m. E. by S. E. of the island of Kiusiu, one of the Japanese islands ; and, lastly, one LEADING 5623 m. S. E. to Cape Romania S. of Malaya.

In passing from Cape Romania to Cape Tamour, we cross the Great Desert of Shamo, where the traveller is frequently obliged to quench his thirst with LEMONS, 5320 m.

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\* A QUEEN QUITE AWAY IN Asia's (12,118,200) land made MARS (390,000,000) of the population of her country.

## LESSON II.

*Seas, Gulfs, Straits, Capes, Isthmuses, Islands, and Groups of Islands.*

No vegetation is seen but Lichens and Mosses 3000 miles along the coast of Siberia, which is within the arctic circle, from Cape Matzol to Cape East in Bhering's Straits.

In the Arctic or Frozen Ocean South of the country of the Yookghirs, and E. of the river Lena, are three islands, viz.

1. Kotchnoi: 2. Fadeoskoi: 3. New Siberia, N. W. WAYS 80 m. of Bhering's Straits is the Gulf of Anadir, which RUNS 420 m. W. by N.: this gulf is NEARLY 245 m. across.

The Aleutian chain, a numerous group of islands, BEARS 840 m. S. of the Gulf of Anadir, and forms the arc of a circle or crescent as we PASS 900 m. E. of the middle of the peninsula of Kamtschatka to the peninsula of Alaska in N. America.

Cape Lopatka TENDS 1260 m. N. W. of Bhering's Straits.

We PASS 900 m. N. by E. up the Sea of Okotsk or Lania from Cape Lopatka.

The Kurile chain, a numerous group of islands, CUTS 710 m. in the form of a crescent from Cape Lopatka to the island of Chika, one of the Japanese islands.

In the Sea of Okotsk is the island of Seghalien.

The basin or gulf of Corea, formed by the islands of Japan and Seghalien, is, mariners TELL us, 1550 m. from N. to S.

West of the peninsula of Corea, the Yellow Sea RUNS 420 m. N., and is NEARLY 245 m. across.

The Chinese Sea washes the coasts of China and Cochin-China, according to geographical TABLES 1850 m. : this basin is formed by several large islands and the peninsulas of Cochin-China and Malacca, and contains the islands of Hainan and Macao near Canton.

From Cape Romania, S. of the peninsula of Malaya, the Strait LEADS 560 m. N. W. into the Gulf of Bengal.

Acheen, a city in Sumatra, E. of the Straits of Malacca, Calcutta, and Cape Comorin, S. of the peninsula of Hindostan, form an equilateral triangle which TENDS 1260 m. each way : this triangle comprehends the Gulf of Bengal, in which are the islands of Ceylon, Andaman, and Nicobar.

S. of Cape Comorin is the Indian Ocean, which MEETING 3123 m. E. and W. with the Gulf of Bengal, and the Arabian Sea that TURNS 1420 m. S. as far as Madagascar.

The Indus TENDS 1260 m. N. by W. of Cape Comorin.

The Gulf of Ormus washes the Persian coast of COCOAS, 770 m.

From the Straits of Ormus the Persian Gulf LEADS 560 m. N. W.

The Arabian Sea, which lies between Hindostan and Arabia, TENDS 1260 m. from the Gulf of Ormus to the Straits of Bab-el-mandel, or the Straits of Misfortune.

The Red Sea TURNS 1420 m. N. W. to the Isthmus of Suez, a DAY'S (60 m.) journey across the Isthmus of Suez to the Mediterranean.

The Mediterranean RUNS 420 m. S. along the coast of Syria, and then RUNS 420 m. W. along the shores of Asia Minor.

The Archipelago GETS 310 m. along the coast of Asia Minor to the Straits of Gallipoli or the Dardanelles.

## LESSON III.

*Chains of Mountains, their Directions and Lengths—and Heights of Particular Mountains.*

THE most elevated mountains in the world surround central Asia, which MEASURES 3040 m. from W. to E., and TURNS 1420 from N. to S. In central Asia is the Great Desert of Cobi or Shamo.

These mountains, called by the ancients the Golden Girdle or Belt, are approached on the E. and W. by a series of plateaux or upland plains, each flanked by mountains which appear like so many terraces rising one above another : these are diversified with hills and valleys formed by various branches of mountains which traverse them in different directions.

The southern declivity of the central Plateau is broken by deep valleys and frightful precipices, the passes over which are 16,000 feet above the level of the sea.

The northern declivity is less precipitous, though its mountains are very lofty and covered with eternal snow.

The Belt or Girdle of central Asia is known under various names, viz.

1. Himaleh chain, South of the central Plateau.
2. Great and Little Altai chain, N. of ditto.
3. Beloor Tag, W. of ditto.
4. Siolki chain, E. of ditto.

1. The Himaleh commences at a point which RUNS 420 m. N. E. of Calcutta, W. of the Burrampooter, and TURNS 1420 m. W. by N., as far as the Hindoo-Koosh at the foot of Beloor Tag.

2. The Beloor Tag, like a COAT (71 deg. long.) of MAIL,



(35 deg.) protects Little Bukharia from Great Bukharia, in Independent Tartary; this chain RUNS 420 m. between the last-named countries, and then divides into two branches, one of which RUNS 420 W. of Kalmookia, and unites with the Little Altai, and the other S. E. terminating in the Great Altai.

3. The Great and Little Altai separate the Siberian NATIONS 2120 m. from the Mongolian.

4. The Siolki chain BEARS 840 m. S. by W., separating Mongolia from Mantchooria, as far as the Great Wall: it then divides into two branches, one of which RUNS 420 m. S. of the Plateau, formed by the Great Bend in the Hoan-ho or Yellow river: this branch again divides and forms the large basin of Setchuen, a province in China. This basin VARIES 640 N. E.

S. E. of the central Plateau are four parallel chains, which pass into the peninsula of India: these mountains give rise to several large and majestic rivers.

#### *Chief Mountains of the Himaleh.*

In the Hindoo-Pantheon the Himaleh chain is deified, and Dawalagiri, the highest peak, is HEAVENLIER (26,254 feet) than the others.

Jamootra, near the source of the Jumna, 25,000 feet.

Dhaiboon, seen from Katmandoo, 24,720 feet.

The height of the Beloor and Altai chains are not accurately ascertained, but they are supposed to be very lofty, and many of their summits are covered with perpetual snow.

The central Plateau is considered the centre from which other branches diverge, the chief of which is the Hindoo-Koosh and Gaorian chains, which appear to unite with

the Taurus and Caucasus of Asia Minor and the Daoorian, which separates Siberia from Mantchooria, and N. of the Sea of Okotsk, through the peninsula of Kamtschatka.

The Daoorian mountains PASS 900 m. between the basins of the Lena and Amoor.

The Hindoo-Koosh we NOTICE 217 m. between Cafaristan and the kingdom of Cabul : a continuation of which, under the name of Gaoorian chain, LEADS 560 m. W. towards the Caspian Sea S. of the Jihon river.

Armenia is the Nucleus of the chief chains of mountains in Asia Minor and of Persia : the chief branches are the Caucasus and Taurus.

1. The Caucasus CUTS 710 m. S. E. from the Black Sea to the Caspian : from the centre of which we NOTICE 217 m., a branch uniting with the Taurus in Armenia.

Taurus, consisting of several branches, BEARS 840 m. W., and forms a plateau in Asia Minor, the centre of which is the city of Koniah, capital of Karamania. One branch of Taurus passes South of the Caspian Sea, and another traverses the West and South of Persia, forming the basin of Shiraz, and then joins the Salmon chain E. of Afghanistan, a branch of the Hindoo-Koosh.

*Chief Mountains of Taurus and Caucasus.*

Elburus, the chief FELLOW (9,558 feet) of the Caucasus.

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#### LESSON IV.

*Chief Valleys ; Elevated Plains ; Plains ; Basins ; Amphitheatres ; Rivers and their Lengths ; and Lakes in Asia.*

##### *Valleys.*

1. The valley of the Enissei, E. of Kolhyvan.
2. The valley of Angora, N. of Lake Baikal.
3. The valley of the Lena, N. of ditto.
4. The valley of the Amour.
5. The valley of the Mekong, Cambodia, and Laos.
6. The valley of the Meinam, kingdom of Siam.

##### *Elevated Plains or Plateaux.*

1. The central plateaux of Asia.
2. The plateau of Persia.
3. The plateau of Armenia.
4. The plateau of Asia Minor.
5. The plateau of Arabia.

##### *Plains.*

1. The plain North of Siberia.
2. The steppes of the Kirguises, N. of Independent Tary.
3. The plain of Mesopotamia.

##### *Basins.*

1. The basin of Cashmere.
2. The basin of Kalmookia.
3. The basin of Kalkas, S. of Lake Baikal.
4. The basin of Shiraz, S. of Ispahan.

*Amphitheatres.*

1. Mantchooria.
2. Siam.

*Rivers.*

The chief of the Asiatic rivers have their source in the mountains of the central plateau.

*Rivers that take their Rise in the Altai Chain.*

1. Obi, Siberia, its waters HEAVING 2623 m. to the Arctic Ocean.
2. Yenissei, separating Western from Eastern Siberia, supplied by streams NUMEROUS 2340 m., enters the Arctic Ocean.
3. Lena, Siberia, waters the Tungoosi NATIONS 2120 m.
4. Amour or Seghalien, Mantchooria, waters a valley according to geographical TABLES 1850 m.; this river enters the Sea of Okotsk.

*Rivers that take their Rise E. of the Central Plateau.*

1. Hoan-ho, or Yellow river, China, has secure HAVENS 2620 m., and enters the Yellow Sea.
2. Yang-tse-Kiang or Blue river, SHAPING 2923 m. its course, enters the Yellow Sea.

*Rivers that take their Rise in Thibet.*

1. Mekong, Cambodia, enters the Chinese Sea.
2. Meinam, Siam, enters ditto.
3. Irawaddy or Irawatty, Birman empire, enters the Gulf of Bengal.
4. The Burrampooter, Thibet, enters the Gulf of Bengal.

These four rivers are each in length, according to geographical TABLES, 1850 m.

*Rivers that take their Source in the Himalah.*

1. Ganges, Hindoostan, waters a country well TILLED 1556 m., and enters the Gulf of Bengal.

2. Indus, of ancient history, leaves many TOKENS (1760 m.), and enters the Arabian Sea.

The Indus has its sources in Mount Kaitos, the residence of the Great BOAT- (81 deg. long.) MAN, \* (32 deg. lat.,) between Little and Great Thibet.

*Rivers that take their Rise in the Plateau of Armenia.*

1. Euphrates, on whose banks stood Babel's TOWERS 1840 m., waters Mesopotamia and Irak Arabi, and then enters the Persian Gulf.

2. Tigris, a tributary of the Euphrates, waters the garden VINES, 620 m.

*Rivers that take their Rise in the Beloor Tag.*

1. Syr-Daria, Independent Tatary.

2. The Jihon or Oxus, ditto.

Each of these rivers enters Lake Aral, and waters an AMPHI-THEATRE 1214 m.

*Rivers that Rise in the Plateau of Asia Minor.*

1. Meander, of which we have often HEARD, 246 m., enters the Archipelago.

2. Kizil-Irmak, course NEARLY 245 m. N., into the Black Sea.

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\* So called because the source of several rivers.



*Lakes of Asia.*

1. The Caspian Sea or Lake waters a COAST 701 m. from N. to S., and several MILES (350) across.
2. Lake Aral is MILES (350) from N. to S., and from the W. E. WAYS 80 m.
3. Lake Palkashi, in Kalmookia, we NOTICE 217 m. from N. to S., and from the W. E. WAYS 80 m.
4. Lake Baikal, Siberia, has MOSS (300 m.) banks.
5. Lake Urmiah, Armenia.
6. Lake Van, Persian Armenia.
7. Lake Zarreh, in Persia.
8. Lake Tikiri, in Great Thibet.

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**LESSON V.***Asiatic Russia or Siberia.\***Bearings and Distances of Cities: their Longitude and Latitude.*

SIBERIA comprehends the whole of Northern Asia along

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\* Besides Siberia in Asia, the Russians have acquired, by conquest, several provinces from Turkey and Persia; these are called the Caucasian provinces; and they consist of, 1st, the province of the Caucasus; 2nd, the province of Circassia; 3rd, the province of Georgia; 4th, the province of Imerity and Mingrelia; 5th, the province of Guria and Awchasa; 6th, the province of Daghestan; and, 7th, the province of Schirwan.

Ekaterine-dara (Catherine's Gift) is the capital of the Tchernomorskoi or Black-Sea Cossacks.

Tefis, capital of Georgia, we NOTICE 217 m. N. W. of Erzerum, as you TURN 142 m. S. W. of the dangerous pass of the Caucasus.

the Arctic or Frozen Ocean, which extends, according to geographical TABLES, 1850 m. towards the south.

The Little and Great Altai mountains, and the Daoorian Chain, separate Siberia from Independent Tartary, Mongolia, and Mantchooria. These chains RISING 4023 m. W. of the sea of Oktosk, continue in the form of a crescent N. of it, and traverse the whole peninsula of Kamtschatka.

Siberia is divided into Eastern and Western Siberia, or into the two great governments of Tobolsk and Irkoutsk.

Each of these governments are again subdivided into four others, viz.

*Western Siberia.*

- |    |                           |                     |
|----|---------------------------|---------------------|
| 1. | The government of Tobolsk | . capital, Tobolsk. |
| 2. | Tomsk                     | Tomsk.              |
| 3. | Kholyvan                  | Kholyvan.           |
| 4. | Eniseisk                  | Eniseisk.           |

*Eastern Siberia.*

- |    |                            |                      |
|----|----------------------------|----------------------|
| 1. | The government of Irkoutsk | . capital, Irkoutsk. |
| 2. | Nertchinsk                 | Nertchinsk           |
| 3. | Yakoutsch                  | Yakoutsch.           |
| 4. | Okotsk                     | Okotsk.              |

Tobolsk TURNS 1420 m. E. by S. of St. Petersburg; QUITTING 1123 m. Astracan N. E. This city lies in a situation DEEP (69 deg.), and LOW (58 deg.) upon the junction of the Tobol and Irtysh.

Tomsk VARIES 640 m. E. by S., and Kholyvan S. E. of Tobolsk; these cities are a small EXTENT 121 m. from each other.

The Sun BEAM (83 deg. long.) at Kholyvan is too weak to raise the LILY, 55 deg. lat.

At Tomsk the people are plain, and we seldom see a BEL-LADY, 85 deg. long., 56 deg. lat.

Eniseisk BEARS 840 m. E. of Tobolsk.

Eniseisk\* is ONE (2 deg. long.) city on the Enissei.

Irkoutsik BEARS 840 m. S. E. of Tomsk and Kholyvan.

Irkoutsik stands on the banks of Lake Baikal like a TREE (14 deg.) ALONE, 52 deg.

Nertchinsk stands upon the Amour RIVER 464 m. E. of Irkoutsik.

We PART 941 m. N. E. of Irkoutsik down the Valley of the Lena to Yakoutsik, which RUNS 420 m. N. by W. of Okotsk.

Yakoutsik produces neither the ROSE nor VINE, 40 deg. 62 deg.

Okotsk is near the LAND'S (52 deg. 60 deg.) End; since it only BEARS 840 m. N. W. of Cape Lopatka, south of the peninsula of Kamtschatka.

#### *Remarks.*

Tobolsk, a Tartar city, is famous for the trade carried on between the Russians, Tartars, Mongolians, and Chinese. The river Irtysh, which TURNS 1420 m. S. E. of Tobolsk, affords a means of easy communication between these different nations.

The Ostiaks, a Nomadic tribe, possess the country N. of the city of Eniseisk and E. of the river Enissei: this river separates Eastern from Western Siberia.

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\* The longitude of Eniseisk is 92 deg. E., but being situated 2 deg. upon the second quadrant, we only express the 2 deg., as the longitude of all places is given according to their situation upon any given quadrant.

The Samoiedes inhabit the whole of the Arctic regions, from 42 deg. to 117 deg. E. longitude: their sledges are drawn by rein-deer and dogs.

The Booraites, Nomades, possess the country about Irkoutsk: they very much resemble in appearance the Kalmucs.

The Tongooses, a Nomadic tribe of Mantchoorian origin, better formed than the other tribes, inhabit the country between the Enissei and the sea of Okotsk.

The Yookghirs, a Samoiedic tribe, possess a large track of sea-coast W. of the river Kovyma, which VARIES 640 m. N. of the sea of Okotsk.

The Tchooksches, a tribe better informed and more intelligent than the Samoiedes, inhabit the N. E. extremity of Asia.

The Kamtschatdales possess the whole peninsula of Kamtschatka.

## LESSON VI.

*Chinese Empire—Little Bukharia and Kalmookia.*

*Bearings and Distances of Cities: their Longitude and Latitude.*

The Chinese empire comprehends,

- |                 |                     |   |
|-----------------|---------------------|---|
| 1. China Proper | . chief cities      | $\left\{ \begin{array}{l} \text{Pekin,} \\ \text{Nanking,} \\ \text{Canton.} \end{array} \right.$ |
| 2. Mantchooria  | . . capital,        |   |
| 3. Corea        | . . . . King-katao. |   |
| 4. Mongolia     | . . . .             | Karakum.  |

- |                        |                 |
|------------------------|-----------------|
| 5. Great Thibet . . .  | capital, Lassa. |
| 6. Little Thibet . . . | Leh or Ladak.   |
| 7. Bootan . . . . .    | Tassasudon.     |

Pekin is the place of residence of the Chinese emperor, who styles himself the **HEAD REX**, 26 deg. 40 deg.

Nanking **LEADS** 560 m. S. by E. of Pekin.

Canton **CUTS** 710 m. S. by W. of Nanking.

From this city the East-India merchants bring their tea **HOME**, 23 deg. long., which has acquired a great **NAME**, 23 deg. lat.

**MILES** 350 N. E. of Pekin is Shin-Yang or Mookden, capital of Mantchooria.

The city is situated in a fine climate, and the people enjoy a **MAY MORN**, 33 deg. 42 deg.

Mantchooria forms one great and two small governments : viz.

The great government of Shing-yang or Shengyn.

#### *Small Governments.*

1. Fyntien or Leao-Tong, cap. Mookden or Shen-Yang.

2. Mantchoo or Amour, and sea of Corea.

Seghalien, on the Amour, **BEARS** 840 N. E. of Pekin, and Nertchinsk the same distance N.

King-Kitao is a distance **VAST**, 601 m. E. by S. of Pekin. In this city they prepare or **MAKE MACE**, 37 deg. 37 deg.

The kingdom of King-Kitao **VARIES** 640 m. from N. to S., and is **NEARLY** 245 m. across.

Karakum, the ancient capital of Mongolia, **BEARS** 840 m. N. W. of Pekin, and **RUNS** 420 m. S. by E. of Lake Baikal.

This city was the capital of the vast empire of Genghis Khan.



Between this city and the city of Irkoutsk is Kiakta, as you TURN 142 m. N. E. of the latter city, a depôt of the Russian Chinese tea-trade.

The traveller TURNS 1420 m. S. by W. of Karakum to Lassa, capital of Great Thibet, which is the same distance W. by N. of Canton in China.

This city LEADS 560 m. N. by E. of Calcutta, and Tasasudon, the capital of Bootan, MILES 350 N. of Calcutta.

Lassa is known to travellers under different NAMES 2 deg. 30 deg.

Leh, Ladak, or Latak, capital of Little Thibet, BEARS 840 m. W. by N. of Lassa.

This is the country of a pastoral people or COW-MEN 78 deg. 32 deg.

Cashgar, in Little Bukharia, not FAR 94 m. N. W. from Yarkand; its capital is MILES 350 N. of Leh or Ladak.

We NOTICE, 217 N. of Cashgar, Kalmookia, or the country of the Kalmucs.

### *Remarks.*

The emperors of China are of the Mantchoo dynasty, a race of people distinct from the Tartars.

China is watered by three majestic rivers supplied by numerous tributary streams and lakes, among the latter is a lake celebrated for its beautiful gold fish, which were first taken to the island of Java, and from thence brought to England in the year 1611. This lake\* is in the province of Tcho-Kiang, forming the first of three terraces as we approach the central plateau of Asia.

The second terrace or province of Hououang is called

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\* This lake is at the foot of a mountain called Tien King.

the granary and garden of China : fruit trees of tropical and temperate climes flourish in this delightful region.

The third terrace or the province of Setchuen forms a basin surrounded by woods, in which are various aromatic and valuable trees, among which is the aloe tree, containing calamba, which sells for its weight in gold. The gold pheasant is a native of China.

Canton, in China, is the mart for the most beautiful porcelain in the world, for nankeens and tea.

Mantchooria was formerly the seat of a powerful empire, whose kings subdued China, the descendants of whom are the reigning dynasty of China. This country possesses the climate of France, but at present is little cultivated, though well watered by the river Amour and its numerous tributaries.

The great wall, extending 500 leagues, separates China from Mantchooria.

Central Asia, forming a vast plateau of great elevation, comprehends the following countries : viz.

1. Little Bukharia. 2. Kalmookia or country of the Kalmucs. 3. Mongolia or country of the Mongols. 4. Tangoot or country of the Eleuths of Koko-Nord or Eastern Kalmucks ; Great and Little Thibet and Bootan.\*

Besides these are the mountainous nations on the western declivity inhabiting Beloor, the plains or valley of Pamer, Kashkar, and Caferistan.

A DAY'S (60 m.) voyage W. of Cashgar we enter the Beloor, which we NOTICE 217 m. N. W.

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\* The people of Bootan are of pastoral habits, but warlike, as they occupy the valleys on the top of the Himaleh mountains ; they frequently descend into the plains below, and plunder the inhabitants.

MILES, 350 S. W. of Cashgar, is the valley of Pamer, S. of which we TURN 142 m. into the country of Caferistan ; these mountains are inhabited by warlike and pastoral tribes.

Little Bukharia is watered by the river Yarkand, which RUNS 420 m. E. into Lake Lop, which has no outlet.

Tangoot is a mountainous country N. W. of China.

Kalkas or country of the black Mongols, is a basin watered by the river Selinga, which enters Lake Baikal.

## LESSON VII.

*Independent Tartary ;\* Turkey in Asia ; and Persia.*

*Bearings and Distances of Cities : their Longitude and Latitude.*

Independent Tartary .	chief cities	} Samarkand, Bokhara, Taschkund.
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The traveller passes JUST 501 m. W. by N. across the Beloor mountains to Taschkund capital of Turkestan, a city NEARLY 245 m. N. W. of Samarkand.

From Samarkand, as we TURN 142 m. E. of Bokhara, we PASS 900 m. N. W. to Astrakan : this city TENDS 1260 m. N. E. of Constantinople.

Samarkand is situated favourably for merchant DEALERS, 65 deg. 40 deg.

\* Independent Tartary at present consists of the following countries or states, viz. Turkestan, Bokharia, Karasm, capital Khiwa, which TAKES 170 m. S. of Lake Aral.

*Turkey in Asia.*

Turkey in Asia comprises,

1. Asia Minor . . . . . capital, Smyrna
2. Syria and Palestine . . chief cities { Aleppo,  
Damascus,  
Jerusalem.
3. Arabia . . . . . chief cities { Mecca,  
Medina.
4. Irak-Arabia, Babylonia . . . . . Bagdad.
5. Algeziras . . . . . } Mesopotamia { Diarbekir,  
6. Diarbekir . . . . . } Mosul.
7. Armenia . . . . . Erzerum.

Smyrna we NOTICE 217 m. S. by W. of Constantinople. Smyrna is a NICE (27 deg. long.) city, called the Queen of Asia.

Aleppo LEADS 560 m. E. by S. of Smyrna, and S. E. of Constantinople. Aleppo, both longitude and latitude, will MAKE GOOD 37 deg. 36 deg.

Damascus TAKES 170 m. S. by W. of Aleppo.

From Damascus we TURN 142 m. S. W. to Jerusalem.

In Jerusalem was observed the Paschal or GALA MOON 35 deg. 32 deg.

Medina is a distance VAST 601 m. S. by E. of Jerusalem.

Mecca we NOTICE 217 m. S. of Medina. At Medina will ARISE (40 deg.) the HOLY (25 deg.) Prophet Mahomet.

Bassora, a city on the Euphrates, Mecca and Jerusalem, form an equilateral triangle.

Bagdad is at MOST 301 m. N. E. of Bassora. Bagdad was the seat of the ROYAL MAGI 45 deg. 33 deg.

Mosul we NOTICE 217 m. N. W. of Bagdad: opposite this city E. of the Tigris was the ancient Nineveh.

Diarbekir we NOTICE 217 N. W. of Mosul, a city that TAKES 170 m. S. E. of Erzeroum.

Erzeroum one VIEWS 680 m. E. of Constantinople.

Bidlis RUNS 420 N. by W. of Bagdad.

Ispahan, capital of Persia,\* RUNS 420 m. E. by S., and Tehran E. by N. of Bagdad. Ispahan was the seat of the worshipers of fire or the LAMA MAGI, 53 deg. 33 deg.

Tehran we NOTICE 217 N. by W. of Ispahan.

### *Remarks.*

Asia Minor comprehends the ancient provinces of Lydia, Pamphylia, Pisidia, Lycaonia, Cilicia, Pontus, Cappadocia, and the seven Churches of Asia, mentioned in the Revelation. Tarsus, the birthplace of St. Paul, Brusa, near the Sea of *Marmora*, the ancient capital of the Ottoman empire, and Ephesus, so celebrated for the Temple of Diana, are cities of Asia Minor.

In Syria is Mount Libanus, so celebrated for its cedar trees in the time of Solomon, and still noted as being the residence of the Maronites and Druses, the latter of whom are a warlike people, and have always retained their independence.

Aleppo is the second city in Asia, and has several times been destroyed by earthquakes. The best Pestachio nuts are produced in the neighbourhood of this city.

Damascus, called by Mahomet a paradise, is situated in a beautiful valley, having Mount Libanus on the South:

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\* Persia at present comprehends the following provinces, viz. 1. Erivan (Persian Armenia). 2. Adzerbidjan. 3. Ghilan. 4. Mazaderan. 5. Khorazan. 6. Irak-Adjemi. 7. Persian Koor-distan. 8. Faristan. 9. Kerman.



this city forms a delightful garden, in which are found the most delicious fruits of Europe and Asia.

The celebrated city of Palmyra, the Tadmor of Solomon, TAKES 170 m. N. by E. of Damascus and the same distance E. by S. of Aleppo.

Jerusalem, the city of David and capital of Judea, was destroyed by Titus in the year 71, according to the prophecy of OUR SAVIOUR, who was crucified in this city.

Arabia is physically or naturally divided into three regions, viz. Arabia Felix, Arabia Petrea, and Arabia Deserta. Along the banks of the Euphrates are vast deserts, which penetrate far into the interior of the country; these are connected with the deserts of Mesopotamia. The centre of Arabia forms a vast plateau of considerable elevation, on which are several oases and fertile valleys possessed by independent tribes.

Arabia, the country of Mahomet, produces the finest coffee in the world, in the neighbourhood of Mocha, a city that LEADS 560 m. S. by E. of Mecca; and a tamarind tree, from which a gum exudes in June and July, which the Arabians call El-Mann, supposed to be the manna of Scripture. Peculiar to Arabia is the dromedary, a camel, so called from *dromas*, runner.

In Armenia is Mount Ararat, on which Noah's ark rested: Armenia belongs partly to Turkey and partly to Persia. The basin of the Araxes, in Persian Armenia, forms a beautiful valley, and is supposed to be the first cradle of the human race: the vale of Eden, the happy abode of our first parents. Paradisos is derived from the word *pardes*, a term applied to royal parks in Persia.

In Faristan is the delightful valley of Shiraz, in which are produced the finest grapes, yielding the most delicious wines.

Not far from Kom, a city S. WAYS (80) of Tehran, is the celebrated mountain of Telésmé, from which is derived the word Talisman.

In Persia are large deserts extending a distance VAST 601 m.: upon the borders of one is Lake Zareh, without an outlet, which receives a large river and its tributaries, forming the valley of Seistan.

### LESSON VIII. AND IX.

*Caubul; India within the Ganges; India without the Ganges; and Japan.*

*Bearings and Distances of Cities, their Longitude and Latitude.*

#### *Caubul.*

THE kingdom of Caubul comprises,

- |                       |                  |
|-----------------------|------------------|
| 1. Afganistan *.....  | capital, Caubul. |
| 2. Balk .....         | Balk.            |
| 3. Cashmere .....     | Cashmere.        |
| 4. Beloochistan ..... | Kelat.           |
| 5. Moulton .....      | Moulton.         |

\* The two Persian provinces of Seistan and Kandahar were lately ceded to the kingdom of Caubul. Herat, a flourishing city, RUS 420 m. W. of Caubul, and is half way to Astrabad, a trading town on the Caspian Sea.

Caulbul, rival of Persia, is the capital of a great POWER 984 m. from Ispahan E. by N.

Balk we NOTICE 217 m. N. W. as we cross the Gaoorian mountains.

The basin of Cashmere RUNS 420 m. E. of Caulbul.

Kelat RISES 400 m. S. by W. of Caulbul.

Moulton is MILES 350 S. E. of Caulbul, and RUNS 420 N. E. of Tatta.

Tatta, capital of the Sinde, is within VIEW, 68 deg. of the HOLY (25 deg.) Indus.

*India within the Ganges.*

India within the Ganges comprises,

1. Hindostan Proper..... capital, Benares.

2. The Deccan .... . Hyderabad.

Hindostan Proper comprehends the following independent states :

1. Sinde ..... capital, Tatta.

2. Moulton ..... Moulton.

3. Punjab or country of the Seiks Lahore.

4. Nepaul..... Katmandoo.

5. The Presidency of Bengal .. Calcutta.

Calcutta TENDS 1260 m. E. by S. of Tatta,

At Calcutta the Indians to the British NAME BOW, 23 deg. 88 deg.

The traveller passes through Delhi, which BEARS N. W. 840 m. of Calcutta, and SETTLES (1150 m.) a time at Lahore, a city that MAKES 370 m. S. E. of Caulbul on his way to Balk.

Katmandoo RUNS 420 m. N. W. of Calcutta.

The Deccan comprehends the Peninsula south of the Nerbuddah, subject to the Presidencies of Bombay and Madras.

The Presidency of Bombay comprehends the country N. of the river Krishna, viz.,

1. Behrar or Eastern Mahrattas...capital, Nagpour.
2. Poonah or Western Mahrattas                      Poonah.

The Presidency of Madras comprehends the country South of the river Krishna.

Mysore.....capital, Seringapatam.

Travancore \* ..... Travancore.

Cochin..... Cochin.

Bombay is THE (1000 m.) W. by S. of Calcutta, and VARIES 640 m. N. W. of Madras.

TURN 142 m. E. by S. of Bombay to Poonah.

Nagpour RUNS 420 m. E. by N. of Bombay.

Madras BEARS 840 m. N. W. of Calcutta.

Madras is situated near the BOTTOM (81 deg. 13 deg.) of a plain on the sea-coast.

Seringapatam we NOTICE 217 m. W. by S. of Madras.

Travancore is a city NICE (27 m.) N. of Cape Comorin.

Cochin is situated as you TURN 142 m. N. of the Cape Comorin.

#### *India beyond the Ganges or Chin-India.*

1. Birman empire .....capital, Ummerapoor.
2. Siam empire ..... Siam.
3. Malaya ..... Malacca.
4. The empire of Anam or Cochinchina, Kehoa.

The Birman empire comprehends the following kingdoms, viz.

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\* The Portuguese navigators, in 1505, first landed in Cochin. Cochin, Mysore, and Travancore, are governed by Rajas, subject to the East-India Company.

1. Ava \*.....capital, Ummerapoor.
2. Aracan ..... Aracan.
3. Pegu ..... Pegu.
4. Martaban ..... Martaban.

Ummerapoor **LEADS** 560 m. E. by S. of Calcutta : this city is the capital of the Eastern **CANAAN**, 7 deg. 22 deg.

Aracan, **NEARLY** 245 m. S. W. of Ummerapoor, **GAINS** 320 m. S. E. of Calcutta.

Ragoon **RISES** 400 S. of Ummerapoor, South **WAYS** 80 m. of Pegu.

E. **WAYS** 80 m. of Ragoon is Martaban.

Siam **GAINS** 320 m. E. of Martaban.

Siam, of Eastern splendour, is the **THEATRE**, 12 deg. 14 deg.

Malacca **BEARS** 840 m. S. of Siam.

Cambodia **CUTS** 710 m. N. E. of Malacca.

Cambodia is the seat of **TRITON**, 14 deg. 12 deg.

### *The Empire of Anam or Cochin-China.*

The empire of Cochin-China comprehends the kingdoms of

1. Cochin-China ..capital, Kehoa.
2. Cambodia..... Cambodia or Lawaik.
3. Tongking ..... Kes-pho.
4. Laos..... Lant-Shang.

\* N. W. of Ava are two kingdoms, tributaries of the Birman empire, viz.

Cassay..capital Munnipoora. The **LUNAR** (5 deg. 24 deg.) city.  
Cachar.. Kaspoor. S. of Achem.

The kingdom of Achem or Assam, N. of the two last kingdoms, is situated on the banks of the Burrampooter and Ghergong; its capital **RUNS** 420 N. E. of Calcutta.



Kehoa a direction **MAKES**, 370 m. N. by E. of Cambodia. In this country the natives are subject to Tic-Doleureux or Tic-Tic, 17 deg. 17 deg.

Kes-cho, **QUITTING** 1123 m. E. by S. of Calcutta, **CUTS** 710 m. N. by E. of Cambodia.

Kes-cho is **JUST** 501 m. S. W. of Canton.

Jeddo, the capital of Japan, **TENDS** 1260 m. E. by S. of *Pekin*.

The Japanese worship their king, and call **REX** a **GOD**, 40 deg. 36 deg.

### *Japan Empire.*

The empire of Japan consists of several islands on the East of the Gulf of Corea, the chief of which are,

1. Nippon.....capital, Jeddo.
2. Kinsin .....
3. Sikokf .....
4. Jesso ..... Matsumai.

### *Remarks.*

The river Caubul, a tributary of the Indus, waters the plains of Caubul and Peshawer, a city that **TAKES** 170 m. E. of Caubul; these plains, S. of the Hindoo-Koosh, are spoken of by travellers as being the most enchanting. The High Peak, called Coond of the Hindoo-Koosh, E. **WAYS** 80 m. of Caubul, is separated by the river Caubul from that Suffaid-bol, which is considered the centre of the Afghanistan mountains: from this point the Solomon chain continues **MILES** (350) S. as far as Kelat.

The greatest river of W. Afghanistan is the Helmund, called, in some maps, Hendmind: it has its source, as well as several of its tributaries, in the Gaoorian chain, and issues

into the cultivated plain of the Dooranee\* territory ; after which it enters the Sandy Desert, and terminates in lake Seistan, which has no outlet.

Balk or Bulk is considered the most ancient city in this part of the world, being supposed to be Bactra, capital of Bactria.

The Belooches, who are considered a cruel race, existing on plunder, occupy the greatest part of Mekran along the sea-coast, South of Afghanistan.

Moultan, a part of India within the Ganges, is subject to the King of Caubul : this territory GAINS 320 m. E. of the Indus, and terminates at the mouth of the Punjab, about the same distance from the sea : the Punjab is formed of the five rivers which water the country of the Seiks : N. W. of this country stands Attock, a city which we NOTICE 217 m. E. of Caubul : at this place Alexander the Great, Tamerlane, and Nadir-Shah, entered India.

The beautiful and fertile valley of Cashmere is watered by the Jilum, a tributary of the Punjab, being surrounded on all sides by lofty mountains. The city of Cashmere is the largest in the Afghan dominions, containing a population of 200,000 souls, occupying 16,000 looms. Cashmere shawls, made of fine goat's wool, are manufactured here.

The Sinde is an independent state, which GAINS 320 m. along the banks of the Indus : it is governed by Emirs. The Zingarians, Bohemians, and Gypsies, are supposed to have emigrated from this part of India.

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\* The Dooranees are the largest tribe of the Afghans, and at present they are considered the ruling tribe, as the king of Caubul belongs to it. The Afghans consider themselves descended from Afghan, the son of Irnia or Berkia, son of king Saul.

Lahore was the place of residence of Akbar, a Mogul emperor, and in which he built a royal palace. The river Sutledge is the Eastern boundary of the Punjab, or country of the Seiks, and takes its rise N. E. WAYS 80 m. of the Ganges, on the N. of the Himaleh chain.

Agra, which QUITS 110 m. S. E. of Delhi, the residence of the Mogul emperors, is supposed to be the birthplace of the Avatar or Incarnation of Vishnu, under the name of Parasee Rama, who extended his conquests to Ceylon.

Delhi is celebrated for its imperial palace of red granite, 1000 yards long and 600 broad, which cost £1,000,000 sterling to build. Here was the magnificent throne of gold, over which was placed, with extended wings, a golden peacock adorned with precious stones.

Benares, a diamond mart, is rendered famous on account of the marvellous stories related of it: the Brahmins believe that it was originally built of gold, but in consequence of the sins of the people it was converted into stone: they also maintain that the physical foundation of this city differs from the rest of terrestrial matter, and that it rests on the point of Siva's Trident, whilst the earth rests on the thousand-headed serpent Ananta (emblem of eternity). In this city is the famous Lingam, a petrification of Siva himself, and there are no fewer than a million of images of him. The city is considered sacred ten miles round it, and contains a temple of red stone, dedicated to Visvisha, also a statue of a bull, and a living one is always kept in it, as in the temple of Apis, in Egypt.

The Sunderbund, or Delta of the Ganges, is chiefly resorted to by wild beasts and enormous serpents. The Ganges, with its thousand tributaries, like the branches of the fruitful banyan tree, fertilizes a soil which supports a

population of 57,000,000 of people, who are under the Presidency of Bengal.

Nepaul consists of two valleys, formed by the Himaleh chain.

The Peninsula of the Deccan consists of a plateau, formed by the Ghauts and other chains branching from it; the Bala or High Ghauts E. of Surat, LOSING (5023 feet high) themselves in the clouds, are the most lofty.

The city of Poonah constitutes a pantheon, as the history of Brahminical gods may be studied in the names of the streets, which are called after mythological persons.

In Chin-India are three magnificent valleys, watered by three great and noble rivers, viz. those of Ava, Siam, and Cambodia; these valleys are formed by four parallel ranges of mountains, whose sides are covered with trees bearing eternal verdure. Forests of ebony rise in their native soil, as well as other valuable woods, producing various dyes. The banyan tree, bread fruit, and mango, are every where seen, and the pine apple of Malaya is esteemed the most delicious in the world. The Emperor of the Birman empire is sole proprietor of elephants, and a white elephant is superbly lodged near the royal palace; he is sumptuously clothed and fed, provided with functionaries like a second monarch, held next in rank to the king, and superior to the queen, and made to receive presents and other tokens of respect from foreign ambassadors.

The Siamese call themselves Tai or Free-men: their country is marshy and abounds in forests, the abode of serpents, the baboon and ourang-outang, elephant, rhinoceros, tiger, and leopard, animals common to Chin-India.

On the banks of the Meinam are seen crocodiles 50 feet long, and the trees on its banks are covered with a phos-

phoric fly, which emits and retains light with the regularity of a machine.

Off the coast of Malaya is the island of Poolo Penang, of which an English captain was made sovereign, he having married the daughter of the king. The captain made a present of this island to the English, and it is now called Prince of Wales' Island : it commands the Straits of Malacca.

Laos is a mountainous country, and little known ; but it is remarked by travellers that it produces excellent rice, and that elephants so abound in the forests, that the country derives its name from that circumstance.

Anam, commonly called Tonquin, from the name of its capital, is a fine country, abounding in rice and delicious fruits. Ton-kin or Don-kin signifies "court of the East;" it is known by the common people under the name of Kescho.

Cochin-China, or Southern Anam, is now the chief state of the empire.

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## PART III.

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### A F R I C A.

#### LESSON I.

*Africa : Situation ; Length and Breadth : Area ; Population ; Outlines.*

AFRICA was little known to the ancients ; yet we learn from the sacred historians that gold and ivory, obtained from the Eastern coast, were objects of commercial enterprise ; and it is probable that the Ophir of Solomon was no other than Sofala, a Portuguese possession, in the kingdom of Botong, North of the river Zambeze, whose waters are enriched with gold, which abounds in the mountains of that country.

It was from the African shores that the colonies of Egypt brought to Europe the first germs of civilization, and taught its rude inhabitants to till and cultivate the ground.

The greatest part of Africa lies within the Tropics, and consequently is exposed to a vertical sun, which renders the climate insupportable to Europeans. Great part of the country is one vast desert covered with moving sand, frequently assuming the appearance of the waves of the sea, and burying within its bosom the caravans of Egypt and Morocco as they pass to and from the interior. Yet amidst the deserts of Africa are a few oases, which, like islands in the vast ocean, offer refreshment to the weary traveller. Yet Egypt, Algiers, the Cape of Good Hope,

Caffraria, and the kingdom of Botong, are rich in soil and well watered.

Africa forms one vast plateau, which extends from 37 N. to 35 deg. S. latitude, and from 18 W. to 51 deg. E. longitude.

The breadth and length of Africa are measured by its RIVERS, (4640 m.,) in and themselves LOSING, (5023 m.).

The superficial area of Africa is 8,517,000 \* square miles, and its population 80 millions.

The continent of Africa has its outlines marked by four great promontories, viz. 1. Cape Serret, which projects far into the sea on the N., and TENDS 1260 m. N. by W. of the Nile: from Cape Serret we PART 941 m. to the Straits of Gibraltar. 2. Cape de Verd, which is, according to geographical TABLES, 1850 m. S. by W. of the Straits of Gibraltar, half-way to the E. of the Gulf of Guinea. 3. Cape of Good Hope S. of the people of Guinea, who imitate the custom of the Portuguese NOBILITY, 2851 m. 4. Cape Guardafui, we MAY FIND 3926 m. N. E. of the Cape of Good Hope; from this point we pass through several savage NATIONS 2120 m. to the Mediterranean Sea.

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## LESSON II.

*Seas, Gulfs, Straits, Islands, their Situation and Produce.*

IN the Mediterranean Sea, N. of Africa, is the Gulf of Syrtis or Sidra, which VARIES 640 m. W. of Alexandria: this gulf we NOTICE 217 m. inland.

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\* OBI LATACOO (8,517,000) cultivating BEES (80,000,000).

Passing along the gulf Syrtes, the Gulf of Cabes LEADS 560 m. W.

The Atlantic washes the Western coast of Africa, in which are the following islands, viz.

#### 1. *The Azores.*

St. Michael, as we PASS 900 m. W. of Lisbon.

St. Maria, S. of St. Michael.

Terceira, HEAD (26 deg. long.) island, TAKES 170 m. N. W. of ditto.

St. George, S. W. WAYS 80 m. of Terceira.

Graciosa, W. WAYS 80 m. of ditto.

\* Flores, as you TURN 142 m. W. of Terceira.

Corvo, N. WAYS 80 m. of Flores.

#### 2. *Madeiras.*

Madeira LEADS 560 m. S. E. of St. Michael, off the ARABS' (480 m.) kingdom of Morocco.

Porto Santo, N. E. of Madeira.

#### 3. *Canary Islands.*

Teneriffe is NEARLY 245 m. S. of Madeira.

Fortuventura, as you TURN 142 m. S. of Africa.

Great Canary, S. E. WAYS 80 m. of Teneriffe.

Gomera, near Teneriffe.

Palma, E. WAYS 80 m. of Teneriffe.

Ferro, S. WAYS 80 m. of Palma.

#### 4. *Cape de Verd Isles.*

St. Jago we reach, QUITTING 1123 m. S. by W. of Teneriffe: this island is NEARLY 245 W. of Cape de Verd.

Brava, W. WAYS 80 m. of St. Jago.

Bonavista, QUILTS 110 m. N. E. ways of ditto.

St. Nicholas, as you TURN 142 m. N. of ditto.

St. Vincent and St. Anthony, each TAKES 170 m. N. W. of ditto.

Sal TAKES 170 m. N. E. of ditto.

*Remarks.*

In 1757, a great earthquake destroyed St. George and eight small islands.

The coast of Terceira is high, and in part inaccessible : the island is subject to earthquakes—Angra is its capital.

The climate of the Azores is healthy, and milder than in Europe, and the Vino Passado or Malmsey equals in quality the wines of Madeira : it is produced from the plants originally brought from the island of Candia.

When the island of Madeira was first discovered, it was covered with wood, which, on being set on fire, burnt during seven years. The gardens and orchards of this island display a variety of European and tropical fruits. The chief wealth of this island are its wines, Madeira and Malmsey.

The Canary Islands enjoy a good climate and fertile soil. Wines, olives, wheat, maize, and silks, constitute the wealth of the inhabitants.

At the foot of the Peak of Teneriffe, which once the island QUITE RUINED, (11,426 feet,) is one of the finest countries of the world, and produces the most delicious fruits and the highly flavoured wines, Malvoisin and Vidonia.

The mountains of St. Antonio are equal to those of Teneriffe : the valleys of which are fertile in the Indigo plant and cotton, oranges, and lemons. Bonavista is remarkable for its elevated soil. The inhabitants of St. Jago, the principal island, are very miserable in appearance.

LESSON III.

*Lesson II. a Continuation of Lesson I.*

*Islands in the Gulf of Guinea.*

FERNANDO PO, Spanish, NEARLY 245 m. N. of the equator.

St. Thomas, on the equator, as you TURN 142 W. of Africa.

Princes Island, nearly half-way between the two former islands.

Annobona, as you TURN 142 m. S. W. of St. Thomas.

St. Helena, TURNS 1420 m. S. of Cape Palmas, Grain coast, QUITTING 1123 m. the coast of Lower Guinea. In this island Napoleon Buonaparte was DIETED (6 deg. 16 deg.).

Ascension Island BEARS 840 m. N. W. of St. Helena. This island LEADS 560 m. S. of the equator, and is a barren rock it's TRUE, 14 deg. longitude, swarming with a vast number of turtles.

Madagascar, NEARLY 245 m. off the coast of Mozambique.

Comora Isles, N. of the Mozambique channel.

The Isle of Bourbon MAKES 370 m. E. of Madagascar.

The Isle of France TAKES 170 m. N. E. of Bourbon.

JULY, NOTE (55 deg. 21 deg.) is winter in the Isle of Bourbon.

Almirante VARIES 640 N. by E. of Madagascar.

Leychelle Islands TURN 142 m. E. of Cape Guardafui.

Socotra, as you TURN 142 m. E. of ditto.

The chief produce of the islands in the Gulf of Guinea are cotton, tobacco, and sugar.



The NICE (27 m. in circumference) island of St. Helena, whose steep shores form a natural and impregnable rampart, is divided into two unequal parts by a chain of mountains, intersected by deep valleys. The peak of Diana, or the HEAD PEAK, 2697 feet above the level of the sea. In this island Napoleon Buonaparte died after LENT, (5. 21,) 5th month of the 21st year of the present century.

Madagascar \* is the largest of the African islands, and extends from the 12th to 26th degree of South latitude, and from the 45 deg. to 51 deg. of E. longitude.

A chain of mountains runs through the island from N. to S.

Tanane-Arrivon is the capital of the most powerful of the native princes, situated in the centre of the island.

Mouzangaye, MILES (350) N. of Cape St. Mary, is a well-regulated city, possessing an AMUSING, EASY (30,230) population of Arabs, Africans, and Malays.

The island of Bourbon abounds in plantations of cloves and immense coffee trees; the capital is St. Denis.

The Isle of France is less fertile than the Isle of Bourbon. The Capital is St. Louis. The Isle of Rodrigues supplies the former with a vast quantity of turtles: this island RUNS 420 m. E. by N. of the Isle of France.

Socotra possesses a strong soil, and in the valleys aloes and dates flourish. The houses in this island are built of coral.

In Mahé, the largest of the Leychelle islands, is an establishment of nutmegs.

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\* A QUEEN HEAD (12 deg. 26 deg.) of the Island once ruled a ROYAL LOT (45 deg. 51 deg.) of slaves.

## LESSON IV.

*Mountains, their Heights; Rivers, their Sources and Lengths.*

THE mountains of Africa are more distinguished by their length and breadth than by their height: where they do reach a great height, it is by gradual risings, and it is supposed, by the position of the Atlas chains, the Kong and Congo mountains, and Lupata, that the interior of Africa forms an elevated plain, to approach which we must ascend a succession of terraces. The Atlas chain, which **URNS** 1420 m. through the states of Morocco, Algiers, and Tunis, is a series of five or six small chains rising one above another, and inclosing many table lands; the grand chain of which **LEADS** 560 m. S. W. of Algiers, through Morocco. Atlas of the mountains is chief—not **THE LEAST**, 12,501 feet. A chain of mountains extends along the West coast of the Arabian Sea. The mountains of Abyssinia are lofty—**EQUALLING** 15,523 feet in height.

The mountains of the Moon are as lofty, if not of greater elevation, than the mountains of Abyssinia; they extend from Benin to Abyssinia, through several **NATIONS**, 2120 m. N. **WAY** (8 deg.) of the equator.

The mountains of Lupata, or "Spine of the World," seem to extend from Cape Guardafui to the Cape of Good Hope in a direction not well defined: they terminate in the high and barren plains called Karroos, and in steep mountains, with flat summits, one of which has received the name of Table Mountain. The highest summit of this chain is covered with snow, 'Tis **TOLD**, 10,156 feet.

The Congo mountains are very little known.

The Kong mountains give rise to the sources of four

large rivers, viz. the Senegal, Gambia, Mesurada, and Joliba or Niger, and appear to be the nucleus of several smaller chains which branch off like rays.

### *Rivers.*

The Senegal follows a direction towards the WEST 801 miles.

The banks of the Gambia are shaded with DATES 610 miles.

The Mesurada RISES 400 m. N. of the Grain coast.

The Joliba RUNS 420 E. by N. to Tombuctoo; the course of this river is afterwards unknown.

The Bahr-el-Abiad, or White River, rises in the mountains of the Moon, called Dyre and Tegle, which QUITTING 1123 m. S. of Darfoor, it passes in a N. by E. direction till it receives the Bahr-el-Azrek or Blue River, another branch of the Nile, which CUTS 710 N. by W. The Bahr-el-Abiad we NOTICE, 217 m., below the Bahr-el-Azrek receives the Tocazze or Eastern branch of the Nile, which BEARS 840 m. N. E. through the kingdoms of Abyssinia and Sennaar.

The Nile supplies, by annually overflowing its banks, the place of rain from the HEAVENS, 2620 m.

The Cuama or Zambeze has its source in the mountains of Lupata, which BEARS 840 m. W. of Mozambique.

The Zaire or Barbela has its source in the Congo mountains, as we PASS 900 m. into the interior of Africa.

### *Lakes.*

The chief lakes are in central Africa, and several large rivers fall into them: these lakes have no connexion with the sea.

Lake Tchad, W. of Bornou, receives the river Shary.

## 92 CHIEF DIVISIONS OF THE AFRICAN CONTINENT.

Lake Semegonda, E. of Lake Tchad.

Lake Fittre receives the river Misselad, which RUNS 420 m. N.

These two lakes are between Bornou and Darfoor.

Lake Moravi is W. of Mozambique.

The only large valley of Africa is the valley of Egypt, which, from the mountains of Gibbel Silsili, in which are the cataracts separating Egypt from Nubia, is inclosed by mountains on each side JUST, 501 m., as far as Cairo : these mountains, as we approach, branch off towards the E. and W.

The Western mountains, called Gibbel-al-Nairon, are lost in the Libyan Sands, and the Eastern branch, called Gibbel-al-Attaka, extends to Suez.

### TABLES.

#### *Chief Divisions of the African Continent.*

##### *I. Nilotic Countries.*

1. Egypt.....	capital, Cairo.
2. Nubia.....	Deir.
3. Dongola .....	Dongola.
4. Sennaar .....	Sennaar.
5. Abyssinia .....	Gondar.

##### *II. Barbary.*

1. Barca .....	capital, Bengazi.
2. Tripoli .....	Tripoli.
3. Fezzan .....	Mourzouk.
4. Tunis .....	Tunis.
5. Algiers .....	Algiers.
6. Morocco .....	Morocco.

- III. Senegambia.
- IV. Guinea Proper or Upper Guinea.
- V. Western Nigritia.
- VI. Eastern Nigritia.
- VII. Congo or Lower Guinea.
- VIII. Southern Africa.
- IX. Mozambique.
- X. Zanguebar.
- XI. Ajan and Adel.

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## LESSON V.

*Countries; Chief Cities; their Distances, and Longitude  
and Latitude.*

### *Egypt.*

EGYPT is divided into three parts.

1. Bahari or Maritime Egypt.....capital, Cairo.
2. Vostini or Middle Egypt ..... Faioum.
3. Said or Upper Egypt ..... Thebes.

Cairo is situated on the East bank of the Nile, and QUITs 110 m. S. the cities of Rosetta and Damietta, E. and W. WAYS 80 m. of each other. In this city were accustomed to MEET (31 deg.) ancient sages.

Faioum is a DAY's (60 m.) journey S. W. of Cairo. This city is NEAR 24 m. W. of the Nile, N. of Lake Birketel-Cairoon.

Thebes MAKES 370 m. S. by E. of Cairo.

### *Nubia.*

Nubia comprehends the kingdoms of



1. Lower Nubia ..... capital, Deir.
2. Dongola ..... Dongola.
3. Sennaar ..... Sennaar.

Deir CUTS 710 m. S. of Cairo.

Dongola BEARS 840 m. S. by E. of Cairo.

Sennaar RUNS 420 m. S. by E. of Dongola.

Gondar GAINS 320 m. S. E. of Sennaar. Gondar formerly was governed by the GOOD QUEEN, 36 deg. 12 deg., Sheba. Axum, as you TURN 142 m. N. E. of Gondar, was the ancient capital.

### *Barbary.*

Bengazi, E. of the Gulf of Syrta, CUTS 710 m. W. by N. of Cairo.

Tripoli RUNS 420 m. W. by N. of the Gulf of Syrta.

Mourzook LEADS 560 m. S. by E. of Tripoli.

Tunis GAINS 320 m. N. W. of Tripoli.

At Tunis SITS (10 deg.) the only Dey of Barbary that bears the sceptre or MACE (37 deg.).

Algiers RUNS 420 m. W. of Tunis.

Morocco CUTS 710 m. S. W. of Algiers.

### *Remarks.*

Egypt consists of a vale entirely watered by the Nile, which VARIES 640 m. from the N. to the cataracts of Assouan or Syene in the Gibbel el Silsili or chain: we NOTICE (217 m.) the width of this valley.

The Great Oasis GAINS 320 m. S. by W. of Grand Cairo, as one GOES (30 deg. long.) in the HEAD (26 deg. lat.) desert of Selima; the oases of Egypt are inhabited by Bedouin Arabs.

Lake Birketel Cairoon, ancient Mœris, was made by Mœris, a king who held the kingdom in TRUST (1401

B. C.) for the benefit of his people ; near this lake was the celebrated labyrinth of 3000 rooms.

The kingdoms of Nubia are watered by the three tributaries of the Nile, and Sennaar is situated, we NOTICE 217 m., above the junction of the Bahr-el-Abiad and the Bahr-el-Azrek, upon the banks of the latter.

The Shillooks, a negro nation, conquered Sennaar,\* and founded the city of that name.

The coast from Egypt to the Straits of Bab-el-Mandel is known under the name of Troglodytica,† the coast of Aber, or Habesh, or New Arabia.

The country round the Straits of Bab-el-Mandel is called Adeil, and belongs to the kingdom of Adel.

Some parts of Barca are variegated with hills and valleys, and watered by limpid streams, but the South and West of the country is but a desert, where there is neither river nor stream, and the S. wind is insupportably hot. In this desert are two oases ; the oasis of Audela, NEARLY 245 m. S. by E. of Barca, contains three villages, governed by a Dey ; and the oasis of Siwah is NEARLY 245 E. of Audela : this is an independent state,

The coast of Tripoli is rather fertile in dates, oranges, figs, and almonds, but in general the country is barren, and suffers much from the want of water, and from the south winds of the Libyan desert.

The kingdom of Fezzan, which is subject to the Dey of

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\* The province of Kordofan, between Sennaar and the kingdom of Darfoor, is subject to Sennaar.

† The people of this country are called Troglodytes, from the Greek word Trogla, a hole, because the Arabs of this coast live in holes in the rocks.

Tripoli, consists of a few oases between the Tuarik and Libyan deserts.

The Tibboos, a Berber nation, inhabit the desert S. W. of Fezzan.

Tunis, near the site of ancient Carthage, once a powerful Republic, TAKES 170 m. S. of Cagliari, and a distance which EQUALS 150 m. from the coast of Sicily. The country is mountainous towards the S., and the soil sandy and barren, being dried up by the solar heat; but along the coast it is rich in olives. Velvets, silks, and cloth, are the chief manufacture of Tunis. NEARLY 245 S. of Tunis is a large shallow lake called Zoodeah, the ancient Palus Tritonis.

Algiers \* is less sandy and much more fertile than Tunis, and is adorned with hills and well-watered valleys. Jurjura, the highest mountain in Barbary, is 22 m. long, full of rocky precipices, and covered with snow nine months of the year. In this country are several salt-springs and a mountain of rock salt.

Bona, N. E. of Constantine, is a country rich in olives, figs, lemons, and oranges.

Between Algiers and Morocco is the desert of Angara, abounding in lions and ostriches, and it is the retreat of Arabian robbers.

The country of Zab, a plateau S. of Algiers, is inhabited by Arabs or Nomadic berbers, and was under a doubtful obedience to the Dey of Algiers.

The countries of the Wadreag and Guargala, JUST 501 m. S. of Algiers, are governed by independent berbers.

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\* The French took Algiers and deposed the Dey in 1829, and they have now made it a colony of France,

Morocco or Mera-kash was founded in the year 1052. The kingdom of Morocco is W. of the Atlas, but that of Fez N.: these kingdoms are fertile and well watered; and Morocco supplies Spain with wheat and barley.

The kingdoms of Taflet and Dara, E. and S. of Mount Atlas, possess a barren and sandy soil.

*The Land of Dates.*

The Land of Dates is a stripe of land extending from the Atlantic to Egypt, including Darab, Taflet, Segelmessa, Tegorarin, Zab, Guangala, Fezzan, Totser, and the oases of Andela and Siwah.

The country of Totser belongs to Tunis, and is sometimes called Belad-el-Djerid or Beledulgerid.

The Great Desert is a table-land covered with burning and moving sands, with some rocky heights and valleys, the length of which embraces many NATIONS 2120 m. from W. to E.; and the Caravan TURNS 1420 m. from Tunis to Agades in the S., which LEADS 560 m. E. by N. of Tombuctoo. In this desert ostriches roam in numerous flocks, and the lion, panther, and serpent, are a terror to the traveller.

The sea-coast, that LEADS 560 m. N. E. of Cape Blanco, is inhabited by the Mongearts, monsters of cruelty, who endeavour to tempt the mariner on the coast by means of false marks.

The country, MILES 350 S. of Cape Blanco to the Senegal, abounds in the gum forests, which are in the possession of three tribes, called the Trarsas.

In 1805, an akkabah or caravan, of 2000 persons and 1800 camels, was destroyed by burning winds and waves of red sand.

## LESSON VI.

*Cities, their Bearings and Distances, with their Longitude and Latitude.*

*Senegambia.*

*Tribes.*

1. Foulahs. 2. Jaloffs. 3. Feloops. 4. Mandingoes.

*Chief Cities.*

Madina, capital of Jaloffs.

Teembo, Soosoo.

Kong, Kong.

Sego, Bambara.

Madina we NOTICE 217 m. E. of the mouth of the Gambia, in the country of the Jaloffs. At the village of Kongou, near this city, Mungo Park saw one TIME (13 deg. long. W.) it is TRUE (14 deg. lat.) Mumbo Jumbo.\*

Teembo is MILES 350 S. E. of Madina. In this city the king of the Soosoos SITS (10 deg. long.) on the SEATS (10 lat.) of his ancestors.

The Foulahs and Mandingoes inhabit the country South of the city of Teembo.

Kong is JUST 501 m. E. by N. of Teembo. The chiefs of Kong govern by an ORATION, 4 deg. 12 deg.

Sego TAKES 170 m. N. by E. of Kong, and GAINS 320 m. W. by S. of Tombuctoo.

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\* Mumbo Jumbo is a hideous idol, and is the representative of an imaginary person of great importance, whose duty is to keep the wives of Kongou in order.



*Guinea Proper or Upper Guinea.*

Sierra Leone.

Grain Coast.

Ivory Coast.

Slave Coast.

Dahomey.....capital, Abomey.

Benin ..... Benin.

Ashantee ..... Comassy.

Waree ..... Waree.

Sierra Leone LEADS 560 m. S. E. of the mouth of the  
Gambia, and the same distance N. of the Equator.

We PASS 900 m. along the coast from Sierra Leone to  
the coast of Dahomey, and Benin RUNS 420 m. farther E.

The king of Benin has a LADY (5 deg. 6 deg.) guard.

Abomey is MILES 350 W. by N. of Benin.

Comassy we NOTICE 217 m. W. by S. of Abomey.

Waree is S. WAYS 80 m. of Benin.

*Nigritia or Soudan.**Chief Kingdoms.*

Sackatoo .....capital, Sackatoo.

Tombuctoo ..... Tombuctoo.

Agades..... Agades.

Kashna..... Kashna.

Housa ..... Kanoo or Housa.

Bournou ..... Bournou.

Darfoor..... Cobbe.

Sackatoo LEADS 560 m. N. by E. of Benin, and Kanka  
VARIES 640 m. E. of Sackatoo: half-way between these  
two cities is Kanoo, a little to the South.

Tombuctoo is MILES 350 W. by N. of Sackatoo.

Agades is NEARLY 245 m. N. E. of Sackatoo.

We TURN 142 m. E. of Sackatoo to Kashna, on the road to Kanka on Lake Tchad.

We PASS 900 m. W. by N. of Kanka, through the kingdom of Begharme to Cobbe, capital of Darfoor.

Cobbe is the seat of a monarchy flourishing like a NEW TREE, 28 deg. 14 deg.

Lake Fittre is nearly half-way between Cobbe and Lake Tchad.

*Congo or Lower Guinea.*

Loango.....capital, Loango.

Congo ..... St. Salvador.

Angola..... Loando.

Benguela ..... Benguela.

QUITTING 1123 m. S. by E. of Benin, we arrive at St. Salvador, the capital of Congo.—St. Salvador, a holy person was STYLED, 15 deg. 6 deg.

Loango we NOTICE 217 m. W. by N. of St. Salvador, and Loando S. by W. the same distance.

Benguela is JUST 501 m. S. by W. of St. Salvador.

*Southern and Eastern Africa.*

Southern Africa.....capital, Cape Town.

*Mozambique.*

Botong or Sofala .....capital, Sofala.

Mocaranga..... Zimbao.

*Zanguebar.*

Quiloa.....capital, Quiloa.

Melinda . . . . . Melinda.

Ajan ..... chief town, Bráva.

Adel ..... Berbera.

Cape Town is said To BE (18 deg.) MORE (34 deg.) South than any town in Africa.

Sofala TURNS 1420 m. N. E. of Cape Town. Sofala is celebrated for its gold and MELONS, 35 deg. 20 deg.

Mozambique VARIES 640 m. N. E. of Sofala.

The native princes of this coast enjoy the sound of a RAT-TLE, 41 deg. 15 deg.

Quiloa LEADS 560 m. N. by W. of Mozambique.

Melinda RUNS 420 N. by E. of Quiloa, and is NEARLY 245 m. S. of the Equator.

The inhabitants of Brava LIVE 59 m. N. of the Equator. Near Brava many lions ROAR, 44 deg.

Berbera RUNS 420 m. W. of Cape Guardafui.

*Remarks.*

All the country South of the Senegal, watered by the rivers Senegal, Gambia, and Rio Grande, is called Senegambia, from the names of the first two rivers.

The Foulahs possess the country on the banks of the Senegal and S. of the Rio Grande.

The Jaloff's are the most powerful and warlike tribe N. of the Gambia.

The Feloops inhabit the country between the Rio Grande and the Gambia: the Feloops are of a gloomy and revengeful temper.

The Mandingoes are spread over several nations, but their country is situated W. of the river Messurada; they are very mild, sociable, and obliging in disposition.

In the Kong mountains a gum is procured, which is used as bread-fruit.

The chief nations of Nigritia are Darfoor, Bornou, and Tombuctoo; the inhabitants are more skilled in the arts and manufactures than any of the other nations of the

interior ; and a great commercial intercourse is carried on between Tombuctoo, Morocco, Tunis, and Egypt.

Sierra Leone was so called, because the country is very mountainous, and abounds in lions : the English have a settlement on the river of that name ; but the country is unhealthy, and generally proves the grave of Europeans.

The king of Ashantee is very powerful, and can bring a large army into the field.

The king of Dahomey is not so powerful as the king of Benin : in the kingdoms of Dahomey and Benin, human beings are sacrificed at the death of their princes.

In Benin the lizard is an object of worship, and in Dahomey the leopard : the people of Whidah, which is S. WAYS 80 m. of Abomy, regard a serpent as the god of war, trade, and agriculture. It is fed in a kind of temple, and attended by an order of priests.

A king of Ashantee, on ascending the throne, once sacrificed the prime minister, all his slaves, and 336 wives of the late king's : all were buried alive having their bones previously broken.

Congo may be called Table Land, or a plateau ; it is 100 or 150 leagues from the coast : it gives rise to several magnificent rivers, which are not navigable far up the country because of the cataracts. Holcus, of every variety, grows here without culture, and the most delicious of fruits, the Pisang or Java fig.

The kingdom of Matamba, E. of Conga and Benguela, is inhabited by an ignorant and stupid race of Negroes, who know not the nature of a mile : in a Fetich they behold an Amulet, a deity, and a guardian genius : a Fetich man can make any property sacred.

North of Loango are the native dwarfs, called Matembas or Bake-Bake.

The Great Namaquas inhabit the country North of the Orange river, and the Little Namaquas the country South of it. These are two tribes of Hottentots.

The Karroos or plains North of the Cape are destitute of running water, but in the rainy season they are covered with herbs and flowers, but this beauty only continues one month, during which the colonists lead down their cattle, and the antelopes and ostriches descend from the mountains.

The mountains North of the Cape are sections of those terraces by which the central plateau descends towards the sea, and consist of three successive ranges, parallel to each other, and near to the southern coast; these mountains take a direction from N. W. to S. E. The first range is called Lang Kloof, 26 miles from the coast; the second, Zwaite Berg or Black Mountain; the belt of land between them is 26 miles across, and from 80 to 100 miles in length. Beyond this are the lofty Nieuweldts TASTING (10,123 feet high) the clouds—the highest mountains of Southern Africa. Upon these declivities are situated the Karroos. Table Bay Mountain is a good place to study the GLOBES (3580 feet high).

Constantia, an excellent wine, is produced here from plants brought from Shirāz, in Persia.

The Korand Hottentots inhabit the central countries.

The Boschmen or Bushmen, called Saabs, are a tribe of Hottentots: it is a degraded race of beings who exist on plunder.

From the Bay of Algoa, as far as Quiloa, the people resemble each other in physical character. The head of these people is something like the European, and the nose presents a raised arch: the Mahometans called this people



Caffrees or Heretics, and the country was known under the name of Cafarah—Caffraria, which commences JUST 501 m. N. E. of Cape Town: the people are rather handsome, well formed, of peaceful habits, and lead a pastoral life.

Latakoo, capital of the Betjouanas, VARIES 640 N. E. of Cape Town; these people are separated from the Hot-tentots by the desert of the Bushmen.

The kingdom of Sofala belongs to Portugal. The word Sofala signifies, in Arabic, low country. The kingdom of Botonga is sometimes called Sofala, the latter of which terms applies only to the maritime parts of it.

The king of Botonga, preceded by 400 executioners when he goes out in public, assumes the title of Grand Sorcerer and Grand Robber. Four of his ministers traverse the country yearly: one represents the person of the monarch, a second his eye, a third his mouth, and a fourth his ears.

Sena, on the river Zambeze, is a Portuguese settlement.

The Mozambique coast is unhealthy, and dangerous on account of its reefs.

Zanguebar, Ajan, and Adel, are little known, though the Portuguese have been long in possession of the Eastern coast of Africa.

The Giagas or Jagas, a cruel race of Africans, inhabit the interior of the country, E. of Congo.

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## PART IV.

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### NORTH AND SOUTH AMERICA.

#### LESSON I.

*Situation ; Length and Breadth ; Area ; Population.*

AMERICA, consisting of two continents, North and South, is united by the Isthmus of Darien, in the form of a crescent, (MILES 350 m.,) though it LIES 50 m. only from N. to S.

America presents a fine display of the grand and striking features of nature : lofty mountains, deep-entangled forests, immense lakes, and savannas, mighty rivers and foaming cataracts, give a character to this part of the world very distinct from that of Europe, Asia, or Africa.

America derives its name from Americus Vesputius, a native of Florence, who visited it in the year 1497, though Columbus had discovered it five years before.

North America extends from 55 deg. to 168 deg. W. longitude, and from 8 deg. to 74 deg. N. latitude. The length and breadth of North America are measured by its RIVERS, 4640 m.

The area of North America belongs to a PATRIOT NATION, 9,141,212 square miles, and its population is NEAR 24 millions.

1. South America extends from 12 deg. N. to 56 deg. S. latitude, and from 35 deg. to 81 deg. W. longitude.

## 106 SEAS, GULFS, STRAITS, CAPES, PENINSULAS.

2. The length and breadth of South America are measured by its **RIVERS**, (4640 m.,) **MEETING** (3123 m.).

3. The area of South America belongs to a people who claim **KINDRED**, **NOT** 7,264,621 with the Spaniards, their oppressors formerly—but now they are flourishing like Patriots **TRUE** (14,000,000 millions).

4. South America is of the figure of a triangle, the sides of which may be represented by a **RED-MOSS-ROSE**—4600 on the West side, 3000 on the North side, and 4000 on the East side.

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## LESSON II.

### *Seas, Gulfs, Straits, Capes, Peninsulas, Islands—their Situations.*

In the South Atlantic Ocean are six groups of islands, viz.

1. Falkland Isles we **NOTICE** 217 m. N. E. of Staten.
2. Staten is N. E. **WAYS** 80 m. of Cape Horn.
3. Georgia **TENDS** 1260 m. E. of Cape Horn.
4. Sandwich Land is **MILES** 350 m. S. E. of Georgia.
5. New Shetland, **LEADS** 560 m. S. by E., of Cape Horn.
6. Trinidad **CUTS** 710 m. E. of Spirito Santo.

From Cape St. Rogue we **PART** 941 m. N. W. to Marjo Island in the mouth of the Amazon : this island is as you **TURN** 142 E. of the chief branch of the Amazon. **QUITTING** 1123 m. the mouth of the Amazon W., we reach the Caribbean Sea.

The Mariner **URNS** 1420 m. W. along the Caribbean

Sea to Cape Gracios a Dios, in Honduras. This sea is inclosed by a group of islands, called the Great and Less Antilles, or the West Indies, and the continent of America.

### *Great Antilles.*

1. Cuba, capital St. Jago de Cuba, COLON'S\* (75 deg. 20 deg.) Colony, which LEADS 560 m. S. E. of Havannah, a commercial city.

2. Jamaica, capital Kingston, TAKES 170 m. S. by W. of St. Jago.

3. St. Domingo;† its chief cities are Port-au-Prince and St. Domingo.

Port-au-Prince GAINS 320 m. E. of Jamaica, as you TURN 142 m. W. of St. Domingo.

4. Porto Rico, the capital St. Juan, MUST (301 m.) be E. of St. Domingo.

### *Caribbean Isles.*

#### *1. Virgin Isles.*

1. Tortola. 2. Anegada. 3. Virgin, in the centre to which you TURN 142 m. E. of Porto Rico. 4. Gorda.

#### *2. Leeward Islands.*

1. Santa Cruz, Danish, E. WAYS 80 m. of Porto Rico.

2. St. John, NEAR 24 m. N. .... Danish.

3. St. Eustatia ..... Dutch.

4. St. Christopher ..... English.

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\* The name of Columbus.

† In St. Domingo or Hispaniola, the African slaves expelled the French from the island in 1791, and the West part of it they formed into the independent kingdom of Hayti—capital, Cape Town.

5. Antigua, NEAR 24 m. N. of Guadaloupe, English.
6. Anguilla or Snake Island ..... ditto.
7. St. Martin we NOTICE 217 m. E. of Porto Rico.
8. Dominica, S. WAYS 80 m. of Guadaloupe, EVEN-  
TUAL (62 deg. 15 deg.) English.
9. Guadaloupe, NEAR 24 m. N. of Dominica.
10. Maria-Galante, NEAR 24 m. S. E. of *Grand Terre*,  
the largest of the two islands of Guadaloupe : the other is  
called Basse Terre.

### 3. *Windward Isles.*

1. Martinico, NEAR 24 m. S. of Dominica.
  2. St. Lucia, NEAR 24 m. S. of Martinico.
  3. St. Vincent, NEAR 24 m. S. of St. Lucia.
  4. Granada we NOTICE 217 m. S. of Dominica.
- The chain of the Less Antilles terminates at Granada.  
Trinidad, MILES 350 S. of Dominica, and as you TURN  
142 m. S. by E. of Granada.  
Tobago GOES 30 m. N. of Trinidad.  
Margarita, N. WAYS 80 m. of Cumana.  
Curaçoa TAKES 170 m. N. W. of Caraccas, and GOES  
30 m. E. of Oruba.

The Bahama islands are 500 in number, many of which  
are barren rocks : these islands are nearly parallel with the  
COAST (701 m.) of Cuba.

### *Remarks.*

The Caribbean Sea is so transparent in fine weather as to  
make ships appear to float in air.

The island of Cuba and the Bahamas are surrounded by  
labyrinths of low rocks, many of which are covered with  
palm trees.



The heat of the West Indies would be rendered insupportable were it not for the sea breezes which blow regularly from the S. E. during the greater part of the day.

The nights are generally calm and serene, and the moon appears brighter than in Europe. The planets and the luminous light of the galaxy supply the absence, in some measure, of the moon.

The temperate zone of the West Indian islands commences 1500 feet above the level of the sea.

The Colibry or Humming Bird is a native of the West Indies.

The royal palmeto or mountain cabbage grows to the height of 200 feet : yams and potatoes are the food of the negroes.

The dwellings of the settlers are shaded by orange, lemon, and pomegranate trees. The sugar-cane constitutes the chief wealth of the inhabitants : the sugar-cane was originally brought from Otaheite, which is considered to produce the best in the world.

We NOTICE 217 m. from E. to W. in the island of Jamaica, which is only a short distance S. to N. WAYS 80 miles.

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### LESSON III.

#### *Continuation of Lesson II.*

##### *1. The Sea of Honduras and the Gulf of Mexico.*

False Cape, in Yucatan, LEADS 560 m. N. W. of Cape Gracias a Dios, across the sea of Honduras.

Off the E. coast of Yucatan, which extends JUST 501 m. from N. to S., are several islands colonized by the English.

The island of Cuba is considered the key of the entrance to the Gulf of Mexico, which extends from Cape Antonio, in Cuba, to Mexico, as we PART 941 m. W.

Orleans BEARS 840 m. N. by E. of the bay of Campeachy.

*2. Peninsulas, Islands, and Gulfs off the Coast of North America.*

Bermuda TENDS 1260 m. N. of Dominica.

The Peninsula of Florida RUNS 420 m. S. by E. in length.

The Peninsula of Maryland LEADS 560 m. N. by E. of Florida.

Chesapeake Bay TAKES 170 m. inland towards the North.

Delaware Bay QUILTS 110 m. N. of the Chesapeake Bay.

The Sound, between Long Island and New York, QUILTS 110 m. from Delaware Bay.

Delaware Bay goes N. W. WAYS 80 m. towards Philadelphia.

Rhode Island TAKES 170 E. by N. of New York.

N. E. of Rhode Island is the Gulf of Fundy, which RUNS 420 m. W. of the peninsula of Nova Scotia, NEARLY (245 m.) three times long as broad.

St. John (capital of Newfoundland, RUNS 420 m. N. E. of Nova Scotia—this island is the key of the entrance to the river St. Lawrence) stands ALONE\* (52 deg. longitude) to shield or ROBE (48 deg. latitude) the Gulf of St. Lawrence.

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\* The longitude and latitude of St. John.

Iceland\* is, sailors TELL US, 1550 miles N. E. of Newfoundland.

### 3. *Islands in the Gulf of St. Lawrence.*

1. Cape Breton, capital Louisburg, off Nova Scotia.
2. St. John, NEAR 24 m. W. of Cape Breton.
3. Anticosti TAKES 170 m. N. of St. John.

### 4. *Arctic Regions.*

Belleisle RUNS 420 m. N. of St. John's, Nova Scotia.

The Labrador coast CUTS 710 m. N. W. of Belleisle.

Hudson's Strait runs MILES 350 into Hudson's Bay.

A distance VAST 601 m. E. of Hudson's Strait is Cape Farewell, in Greenland: here the fish trade REVIVES 46 deg. 60 deg.

Davis' Strait, with the bay, TURNS 1420 m. N. W. along the coast of Greenland.

North of Hudson's Strait we NOTICE (217 m.) Cape Walsingham.

Barrow's Strait VARIES 640 m. N. W. of Cape Walsingham.

Enter from W. WAYS (80 deg. longitude) Barrow's Straits with CARE (74 deg. latitude).

Melville Island VARIES 640 m. W. of 74 deg. latitude, 80 deg. longitude: in this island Captain Parry, who had the command of the Hecla and Griper, passed the winter of 1819-1820.

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\* Iceland, though generally considered a part of Europe, is evidently a part of the American islands, since it appears to be connected with Greenland by submarine islands. When the winter approaches, the Icclauder travels to Skalholt with H's DEER 20 deg. 64 deg.

The HERO studied with CARE (24 deg. 74 deg.) the good of his men.

5. *Peninsulas, Islands, Gulfs, and Straits, in the Pacific Ocean.*

Bristol Bay VARIES 640 m. S. E. of Bhering's Straits.

The Peninsula of Alaska RUNS 420 S. E.

Nootka TURNS 1420 m. E. by S. of Alaska.

Queen Charlotte's Isle QUILTS 110 m. N. W. of Nootka.

S. E. TENDS (1260 m.) the peninsula of California from Nootka, and CUTS 710 m. W. of the gulf of that name.

The Gulf of Buenaventura NOT MORE (2134 m.) than S. E. of Cape St. Lucas, in California.

The Galapagos isles, the chief of which is Albemarle, BEARS 840 m. W. of Quito.

St. Felix and St. Ambrose are a distance VAST 601 m. W. of Chili: each had a WISE HEAD (80 deg. 26 deg.).

Juan Fernandez RUNS 420 m. S. by W. of Santo Jago.

Cape Horn is South of Terra del Fuego.

*Remarks.*

The islands near Bhering's Straits are divided into several groups: the Aleutian islands constitute a single chain, and may be compared to the piles of an immense bridge by which we may PASS 900 m. from one continent to another: among these are twelve principal islands. Canoes in these islands are ingeniously constructed.

The climate of Nootka is mild, and its inhabitants are above the middle stature, very industrious, and they build their canoes with an outrigger or balance board.

LESSON IV.

*Mountains, Heights and Lengths of Mountain Ranges.*

America appears to be a continuation of the Great Belt of Central Asia, which, hardly interrupted by Bhering's Straits, constitutes the Rocky or Columbian Mountains, the plateau of Mexico and the Great Chain of the Andes.

The Northern portion of these mountains is little known, but we can MENTION 3212 m. N. W. of Mexico, have been observed by travellers.

As one TAKES 170 m. N. W. of Mexico, the plateau becomes MILES 350 m. in width, branching off into three parallel chains W. of the Rio del Norte.

Four plateaux of the Cordillera of the Andes are formed round Mexico.

1. The valley of Toluca is supported by mountain WALLS 8550 feet high.

2. The valley of Tenochtitlan CURVES 7460 feet high.

3. The valley of Octapan, prince of VALLEYS, 6550 feet high.

4. The valley of Istla, in which waters softly MURMUR, is 3434 feet high.

S. E. of the city of Mexico are volcanic mountains, rearing their heads like lofty TOWERS, 1840 feet high.

Izaccis-Huath or White Woman in the Clouds, is shaking and QUAVERING 16,423 feet high.

The Cordillera of the Andes, QUITTING 1123 m. S. E. of Mexico to Lake Nicaragua, in the kingdom of Guatemala, LEADS 560 m. E. through the isthmus of Darien, into the continent of South America.

The Andes of South America give rise to many magnificent RIVERS; 4640 m. from N. to S.

On the ridge of the highest part of the Andes, on the BACKS\* of the mountains, there is a point which forms a double crest. Round this point, which is in fact a valley, there are four mountains, viz.

1. Chimborazi, S. of Quito, of fire emits NOTHING, 21,232 feet high.

2. Pinchincha, which is not FAR (94 m.) South-west of Quito.

3. Cotopaxi is a DAY'S (60 m.) journey South by East.

4. Antisana, ditto, S. E.

5. Cayambe, ditto, E.

Of Pinchincha we have little TIDINGS (16,230 feet high).

Cotopaxi, in the clouds, is TOWERING 18,423 feet high.

Antisana, an earthquake makes its TOPS NOD, 19,026 feet high.

A double chain of mountains forms the plateau of Upper Peru. In these mountains silver mines are worked, EQUALING 1550 feet high.

East of the Eastern chain is an immense plain towards the banks of the rivers Ucayal and Maragnon.

The Andes of Chili equal in elevation those of Peru and Colombia; for Manflos, their chief, his head in the clouds is HOISTING 20,123 feet.

A chain of mountains BEARS 840 m. between the basins of the rivers Madeira and Paraguay, under the name of Reale, uniting with the Marcella, which CUTS 710 m. S. E., connecting the Maritime Cordilleras with the interior.

N. W. WAYS 80 m. of Rio Janeiro are the sources of the rivers Parana and St. Francis: from this point a chain of mountains CUTS 710 m. N. and S., nearly paralalled with the coast.

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\* The valley of Quito is 8770 feet above the level of the sea.



The Alleghany or Apalachian chain of North America RUNS 420 m. in the form of a crescent, S. of the river Tennessee, the convexity of the curve towards the S. : then it BEARS 840 m. N. E., NEARLY (245 m. distant) parallel with the sea.

We NOTICE 217 m. N. W. of Philadelphia, two parallel chains forming a plateau.

The Cumberland Range RUNS 420 m. N. of the basin of the Tennessee.

The mountains of New Hampshire are those of the green and white mountains, the former RISING 4023 feet; and the latter, their summits in the clouds, are seldom VISITED, 6016 feet; the parallel ridges of Virginia, RISING 4023 feet at most, and in many parts much less.

## LESSON V.

### *Rivers, their Sources and Lengths; Lakes.*

#### *Mississippi.*

The Mississippi waters NUMEROUS (2340 m.) Indian nations from the West of Lake Superior to the Gulf of Mexico.

#### *Tributaries of the Mississippi.*

1. Missouri, source, rocky mountains, E. of Nootka, on whose banks, running wild, are many HERDS, 2460 m. : and with the lower Mississippi, whose sides RAILING 4523 m.
2. Arkanza, whose banks produce fine TIMBER, 1384 m. ; source, E. of Santa Fé, capital of New Mexico.
3. Illinois takes its source JUST 501 m. N. E. of the Mississippi, near Lake Michigan.
4. Ohio TENDS 1260 m. S. W. from its source N. W. of Philadelphia.

*Potomac.*

The Potomac, upon which stands Washington, runs NEARLY 245 m. S. E. from its source.

*Susquehanna.*

The Susquehanna GAINS 320 m. S., and enters Chesapeak Bay.

*St. Lawrence.*

The river St. Lawrence, from Lake Ontario, VARIES 640 m. S. E. into the gulf of the same name.

*Mackenzie's River.*

The river Mackenzie, TAKING 1723 m. from S. to N., connects the Great Slave Lake with the Arctic Ocean.

*Columbia or Tacoutché-Tasse.*

The Columbia takes its source in the rocky mountains, and BEARS 840 m. W. to the North Pacific Ocean.

*Colorado.*

The Colorado takes its source in the mountains of New Mexico, and VARIES 640 m. S. by W. to the gulf of California, into which it enters.

*Rio de la Plata.*

On the banks of the Rio de la Plata run wild flocks and HERDS, 2460 m.: this river is formed of the Pilcomayo, Paraguay, and Parana.

The Paraguay, the middle stream, takes its source in Brazil, and TEEMING 1320 m. S., enters Rio de la Plata, as you TURN 142 m. N. of Buenos Ayres.

The Pilcomayo takes its source in the Andes S. WAYS

80 m. of Potosi, and BEARS 840 m. S. E., and forms a junction with the Paraguay W. of Assumption.

The Parana takes its source as you TURN 142 m. N. W. of Rio Janeiro, and VARIES 640 m., then BEARS 840 m. S., forming a junction with the Paraguay.

*Amazon or Maragnon.*

The Maragnon has its source in the Andes N. WAYS 80 m. of the city of Lima, and its waters GAMBOL 3385 m. through the territories of Peru, Colombia, and Brazil, and then enter the Atlantic upon the Equator.

*Tributaries of the Amazon.*

The Ucayali, whose source we NOTICE 217 m. S. E. of Lima, as we PASS 900 m. S. through extensive plains E. of the Andes.

The Madeira takes its source E. WAYS 80 m. of Potosi, and TURNS 1420 m. N.

The Rio Negro has its source in the Andes E. of Quito, and then we PASS 900 m. towards the East along its banks.

*Tocantin or River Grampara.*

The Tocantin has its source, MILES 350 N. W. of Rio Janeiro, and TURNS 1420 m. N., where it falls into the Atlantic near the mouths of the Amazon.

*Oronoco.*

The Oronoco — of this river Raleigh gave a false TIDING (1623 m.) of its bank. It takes its source in Lake Ipava, and falls into the Atlantic near Cape Barima.

*Rio del Norte.*

The Rio del Norte **TENDS** 1260 m. S. by E. along the plateau of Mexico, and then falls into the Gulf of Mexico.

*Lakes in North America.**In the Indian Countries.*

The Great Slave Lake, is **NEARLY** 245 m. from E. to W.

The Great Bear Lake, lies **MILES** (350) N. W. of the Slave Lake.

Athapescow we **NOTICE** 217 m. S. by E. of the Great Slave Lake; Lake Winnipeg, **MAKES** 370 m. S. W. of York Factory, Hudson's Bay.

*Lakes of Canada.*

1. Ontario, **MILES** (350) S. W. of Quebec.

2. Lake Erie **MAKES** 370 m. S. W. of Quebec. Between Lakes Ontario and Erie is the Niagara, so remarkable for its magnificent falls, foaming like the sea **TIDES**, 160 ft.

3. Lake St. Clair is N. **WAYS** 80 m. of Lake Erie, uniting the latter with Lake Huron.

4. Lake Huron **RUNS** 420 m. W. by S. of Quebec.

5. Lake Superior is N. W. **WAYS**, 80 m. of Lake Huron. The narrows or falls of St. Mary are between these two lakes: Lake Superior is the largest body of fresh water that we find in the world; it **MOVES**, (in length 360 m.,) like the sea **TIDES**, 160 m. in breadth.

In the United States are the above lakes, together with Lake Michigan, S. **WAYS** 80 m. of Lake Superior.

*Lakes in the Kingdom of Guatemala.*

Lake Nicaragua, **MILES** (350) W. of Porto Bello.

*Lakes in South America.*

Maracaybo, in Colombia, VARIES 640 E. of Porto Bello.  
 Titicaca, in Bolivia, is NEARLY 245 m. N. by W. of  
 Potosi.

Parima, in Guayana, RUNS 420 m. S. of the mouth of  
 the Orinoco.

*Table of the Political Divisions of North America.**North America.*

- |                          |                  |
|--------------------------|------------------|
| 1. British America . . . | capital, Quebec. |
| 2. United States . . . . | Washington.      |
| 3. Mexico . . . . .      | Mexico.          |
| 4. Guatemala . . . . .   | Guatemala.       |

*South America.*

- |                               |                                      |
|-------------------------------|--------------------------------------|
| 1. Colombia . . .             | capital, Santa Fé de Bagota.         |
| 2. Peru . . . . .             | Lima.                                |
| 3. Bolivia . . . . .          | La Plata.                            |
| 4. Paraguay . . . . .         | Assumption.                          |
| 5. Brazil . . . . .           | Rio Janeiro.                         |
| 6. Guayana . . . chief cities | Demerara.<br>Paramaribo.<br>Cayenne. |
| 7. Chili . . . . .            | capital, San Jago.                   |
| 8. Buenos Ayres . . .         | Buenos Ayres.                        |
| 9. Patagonia.                 |                                      |
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## LESSON VI.

### *Cities, their Bearings, Distances, Longitude, and Latitude.*

#### 1. *British America.*

British America comprehends the following divisions :

1. Nova Scotia . . . capital, Halifax.
2. New Brunswick . . . Frederick Town.
3. Lower Canada . . . Quebec.
4. Upper Canada . . . Montreal.
5. New Britain.\*

Halifax RUNS 420 m. S. E. of Quebec.

Frederick Town, NEARLY 245 m. S. E. of Quebec.

Montreal, we NOTICE 217 m. S. W. of Quebec.

St. John BEARS 840 m. E. by N. of Quebec.

Quebec is S. WEST 801 m. of Nain, in Labrador.

#### 2. *United States.*

The United States consist of twenty-four separate states. United in one republic : and of four territorial governments, besides the great western territory of Missouri.

The United States are spoken of in four divisions :†

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\* New Britain includes Labrador and New North and South Wales, with the coasts round Hudson's Bay ; it is a cold and wild region inhabited by Indians and Esquimaux. In the reign of Charles I. an English company was established for the purpose of trading with the natives for feathers, goose quills, and various skins and furs.

† *Eastern States* : 1. Maine, capital Portland ; 2. New Hampshire, cap. Portsmouth ; 3. Vermont, cap. Montpelier ; 4. Massachusetts, cap. Boston ; 5. Connecticut, cap. New Haven ; 6.



Eastern, Western, Middle, and Southern.

- |                          |                       |
|--------------------------|-----------------------|
| 1. Eastern States . . .  | chief city, New York. |
| 2. Middle States . . .   | { Philadelphia,       |
|                          | { Washington.         |
| 3. Southern States . . . | Columbia.             |
| 4. Western States . . .  | Orleans.              |

New York RUNS 420 m. S. by W. of Quebec, which we NOTICE 217 m. N. E. of Washington. A vegetable production gives the situation of New York—CARROT (74 deg. 41 deg.).

Philadelphia QUILTS 110 m. N. E. of Washington on the road to New York.

Philadelphia is favourable to the growth of CELERIES (75 deg. 40 deg.).

Columbia RUNS 420 S. by W. of Washington.

The COCOA (77 deg.) grows in Washington.

To Orleans we PASS 900 m., which is half way to Mexico.

Rhode Island, cap. Providence. *Middle States*: 1. New York, cap. New York; 2. New Jersey, cap. Trenton; 3. Pennsylvania, cap. Philadelphia; 4. Delaware, cap. Dover. *Southern States*: 1. Maryland, cap. Baltimore; 2. North Carolina, cap. Raleigh; 3. South Carolina, cap. Columbia; 4. Georgia, cap. Savannah. *Western States*: 1. Alabama, cap. Cahawba; 2. Mississippi, cap. Orleans; 3. Louisiana, cap. Arkopolis; 4. Tennessee, cap. Knoxville; 5. Kentucky, cap. Lexington; 6. Indiana; 7. Ohio; 8. Illinois; 9. Missouri.

Besides these States, E. and W. Florida were ceded by the Spaniards to the United States in 1819.

St. Augustine, cap. of E. Florida, CUTS 710 m. S. by W. of Washington.

Pensacola, cap. of W. Florida, GAINS 320 m. W. of St. Augustine.

*Remarks.*

Canada is an elevated country, but not divided by any great chain of mountains: the country is nearly covered with forests, and the cultivation of the ground does not extend far beyond the river St. Lawrence. The soil is better than in the northern parts of the United States, but the Canadians are wretched husbandmen. Canada was formerly called New France, and Quebec, its capital, was taken by General Wolfe, in French Loup (59 or 1759).

Nain,\* on the East coast of Labrador, is an Esquimaux village, the only one in which we find a church, and where the people follow a regular occupation and educate their children.

Hudson's Bay has not yet been fully explored: it EXTENDS 1260 m. N. and S., and BEARS 840 m. from E. to W. The country W. of Hudson's Bay is called New Wales, and that to the E. of it, East Main.

The Great Slave Lake LEADS 560 m. W. of Hudson's Bay, S. of which is the country of the Chippaways: these Indians are generally at war with the Esquimaux. The Knistenaux, called by the Canadians Cristinaux, inhabit the country south of the Chippaways, as far as the Lakes of Canada, and from Hudson's Bay to Lake Winnipeg. The Esquimaux inhabit the Arctic Regions of North America and Labrador. In winter they build and live in huts of snow.

The N. W. portion of America is subject to Russia: the native Indians, who appear to be of the same race as the Tchauktches, inhabit that portion E. of Bhering's Straits.

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\* The people of Nain are VITALLY (61 deg. 55 deg.) enlightened.

South of this tribe are the warlike and ferocious Kolougis, who still carry on an obstinate war with the Russians. East of Nootka is New Georgia, watered by RILLS (45 deg. 50 deg.).

North of New Georgia New Hanover SHEWS (280 m.) along the coast. The climate of New Georgia and of this country is temperate.

New Cornwall we NOTICE 217 m. along the sea-coast N. of New Hanover. This country is cold.

South of Nootka is the territory of Oregon, belonging to the United States, watered by the river Columbia. It enjoys a mild climate and fertile soil.

South of Oregon is New Albion, which CUTS 710 m. along the coast to the Peninsula of California.

E. of Oregon is the territory of Missouri, which forms the basin of the river of that name. This territory, and that of Oregon and New Albion, are inhabited by various tribes of Indians.

The southern States of America are inhabited by planters who cultivate tobacco, cotton, and the sugar-cane, and some of them deal largely in slaves. S. Carolina produces oranges, limes, figs, lemons, and pomegranates, in greater abundance than the other states.

The potatoe of North Carolina, indigenous here, is supposed to have been carried from America into Ireland. The first civilized settlement made in the United States was at James' River, in the State of Virginia, in 1607, the DUSK (1607) or infancy of the American Colonies.

Washington, the capital of the United States, was founded by the great General of that name, who was not born a PAGAN (1732), and died the PAPA (1799) or father of the Americans in 1799.

## LESSON VII.

*Cities: their Bearings, Distances, and Longitude and Latitude.*

*Mexico.*

There are fifteen Federal States of Mexico.

*Chief Divisions of Mexico.*

Mexico . . . . .	capital, Mexico.
New Mexico . . . .	Santa Fé.
California . . . . .	
Yucatan . . . . .	Merida.

Mexico is situated in a valley, the best of STATIONS (11 deg. 20 deg.).

Santa Fé TENDS 1260 m. N. by W. of Mexico.

Cape St. Luca CUTS 710 N. W. of Mexico.

*Guatimala.*

The central kingdom of Guatimala consists of six provinces.

Guatimala BEARS 840 m. S. E. of Mexico.

*Colombia.*

Colombia, formerly the kingdom of Granada and Caraccas, comprehends the following divisions:

1. Cundinamarca . . . . . capital, Bagotá.
2. Quito . . . . . Quito.
3. Venezuela, or Little Venice . . . . . Caraccas.

TAKING 1723 m. S. E. of Guatimala we arrive at Santa Fé de Bagotá.

Quito RUNS 420 m. S. W. of Bagotá.

Caraccas CUTS 710 m. N. E. of ditto.

Santa Fé de Bagotá was made the capital of the Colombian Republic by Bolivar, who died in 1830, after having pursued a glorious CAREER, 74 deg. 4 deg.

Quito is situated on the Equator, lofty in AIR (4 deg.) W. of Santa Fé de Bagota.

Caraccas VIDE (66 deg.) its SITE IS (10 deg.) on the sea-shore.

*Peru.*

Peru . . . chief cities { Lima.  
Cusco.

Lima BEARS 840 m. S. by E. of Quito. In Lima's plains flourishes the COCOA, 77 deg.

Cusco RUNS 420 m. E. by S. of Lima. In Cusco was the ancient palace or royal COTTAGE (71 deg. 13 deg.) of the Incas.

*Bolivia, capital La Plata.*

La Plata BEARS 840 m. S. E. of Lima.

We TURN 142 m. S. W. of La Plata to Potosi.

La Plata received its name from the silver mine on Mount Poreo, a metal desired both by common people and DIVINES (66 deg. 20 deg.).

Chili..... capital, St. Jago.

QUITING 1123 m. S. by W. La Plata we arrive at St. Jago. W. by N. of this city is the Port of Valparaiso not FAR (94 m.) distant.

St. Jago is governed by a Chief greater than a CITY MAYOR 71 deg. 34 deg.

*Argentine Republic, or the United Provinces of Rio de la Plata, capital Buenos Ayres.*

Buenos Ayres CUTS 710 m. E. by S. of St. Jago as one TURNS 1420 m. S. W. of Rio Janeiro.

Buenos Ayres, by the Spaniards, was misgoverned and rebelled; a thing very **DISMAL**, 60 deg. 35 deg.

Don Pedro could not subdue the people of Buenos Ayres, therefore he brought his **ARMY HOME** (43 deg. 23 deg.) to Rio Janeiro.

Bahia or St. Salvador **BEARS** 840 m. N. by E. of Rio Janeiro.

Olinda or Pernambuco **RUNS** 420 m. N. E. of Bahia, a commercial city, to which flock the **MIL-LION** (35 deg. 52 deg.) of merchants.

The Amazon **TENDS** 1260 N. W. of Olinda.

Cayenne **RUNS** 420 m. N. of the Equator: this city belongs to the French **LIONEL** (52 deg. 5 deg.).

**NEARLY** 245 m. W. by N. is Paramaribo belonging to the Dutch.

Demarara we **NOTICE** 217 m. W. by N. of Paramaribo: this city belongs to the English; being unhealthy to Europeans, it puts them in a **Low-KEY**, 58 deg. 7. deg.

### *Remarks.*

Mexico is a word of Indian origin, and signifies habitation of the God of War, called Mexitli. Before 1530 (city of **LIMES**) Mexico was called Tenochtitlan.

The country which long **TIME** (13 deg. lat.) belonged to Montezuma's **HOUSE** (20 deg. lat.) forms a plateau of great elevation, the mountains **VEILING**\* (6523 ft.) the valleys from the **WINDS** (8260 ft.).

On the declivity of the Cordillera, **RISEING** (4023 ft.) till **LOSING** (5023 ft.) one'sself in high mountains, we enter the climate of perpetual spring, is Xalapa, between Mexico and

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\* The plateau rises from 6523 ft. to 8260 ft. above the level of the sea.



Vera Cruz: this is the district where the true Jalap grows. The cold climate is at an elevation one CANNOT (7221 ft.) fly up to. The low lands on the coast are hot and unhealthy, like Vera Cruz. The peninsula of California, called old California, is a barren province, and almost uninhabited.

New California abounds in magnificent forests and extensive savannas, where the Deer and Elk graze in large flocks.

New Mexico is a narrow province W. of Rio del Norte as one TURNS 1420 m. from N. to S., and not FAR (94 m.) across. The settlers in this province are continually interrupted by the Indians. This is the most fertile of the Spanish provinces: wild Sheep and Elks are found in this part of Mexico as well as immense natural meadows abounding in Buffaloes and Wild Horses.

Mexico possesses extensive mines of gold and silver.

At Cholula, a province of Tlascala, is a large Pyramid built of brick, with a temple on the top, in which the Mexicans were accustomed to sacrifice human victims.

Cortez, the conqueror of Mexico, LIT UP (1519) the temple and burnt it to the ground, destroying the DEITIES OF\* (6109) Mexico.

Yucatan is famous for its Mahogany, and a British settlement is established at Honduras to procure it.

The central kingdom of Guatemala we PASS 900 m. through, between Mexico and the Isthmus of Darien: Guatemala, its capital, was destroyed by an earthquake, and 8000 families swallowed up with all their treasures, in 1777.† Two Volcanoes adjacent the town seemed to boil;

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\* More than 6000 persons were destroyed at the burning of the temple.

† The PEAK OAK, or mountain, shook and destroyed the ROSE (40,000) of the population.

one sent forth torrents of fire, the other waves of blazing lava. Honduras is very little known.

The loftiest summits of the Andes are under the equator, near Quito, a province of Colombia, from which, as we approach Santa Fé de Bagotá, we cross deep valleys and frightful precipices. The plateau in which Santa Fé de Bagotá is situated resembles, in many respects, that which incloses the lakes of Mexico. In 1797 the whole province of Quito was destroyed by an earthquake, and the ROSE of the population (40,000) were destroyed in an instant.

The ancient empire of Peru extended from Choco, north of Quito, to the defiles of Taria.

Lower Peru forms an inclined plane, NOT\* (21 m.) more than a DAY's (60 m.) journey across, in which are several deserts, destitute alike of vegetation and inhabitants: neither rain nor thunder has ever been observed in this part of Peru.

Lima, the capital, is situated in the broad and fruitful plain of Rimac, and was founded by Pizarro (LAMIEL) in 1535, the conqueror of Peru.

Precipices and snow-covered mountains form the boundary between Peru and Chili: the coast consists of a narrow beach,† abruptly terminated by lofty hills, whose ridges form a fertile plain, watered by many rivers or streams, enjoying a fine climate. This is the only country in the New World where the grape has completely succeeded.

The Auracians, the most civilized tribe of the unsub-

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\* From 21 m. to 60 m. across.

† The north wind blows, during the rainy season, from May to the beginning of spring, and the south wind during the dry season, or the remainder of the year.

dued Indians, possess the southern parts of Chili: they are governed by a chief, and never build cities, but reside in scattered villages. This tribe never submitted to the yoke of the Spaniards.

West of the Auracanian coast is the Archipelago of Chiloé, consisting of forty-seven islands, thirty-two of which were colonized by the Spaniards and Indians, called Hueiches, faithful allies of the Auracanians. This is a nomadic tribe.

Patagonia, which BEARS 840 m. from N. to S., is inhabited by the Pullches and Patagonians, the latter of whom were so called from *Pen'-agkones*, or men of five cubits.

Terra del Fuego, so called from its burning mountains, is an island, forming the southern extremity of South America.

In the territories of Buenos Ayres are immense plains called Pampas, situated between Chili and the capital; the chief part of which is inhabited by Indians, who migrate with their cattle in quest of pasture, like the hordes of Siberia. An immense number of mules and herds of cattle run wild in the Pampas.

The Empire of Brazil comprehends many Indian NATIONS, 2120 m. in length and breadth. This country is watered by several large rivers which have their sources S. W. of the capital.

The grape yields most delicious wines in the basin comprehending the sources of the Parana; but this being the gold and diamond district, the cultivation of the vine is neglected.

The English, French, and Dutch, have colonized the coast of Guiana, a country that is marshy and covered with forests, in which are found the most active vegetable

## 130 ISLANDS, SITUATIONS AND PRODUCTIONS.

poisons. Vampire Bats, the immense Boa, and the Cayman, are the terror of the Indian.

The Republic of Bolivia occupies the chief district of the silver mines of South America.

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### LESSON I.

#### *Oceanica.*

#### *Islands, Situations, and Productions.*

Oceanica is divided into 3 divisions :

1. Western Archipelago or Indian Archipelago.
2. Australasia including Australia.
3. Eastern Archipelago or Polynesia.

#### *Western Archipelago or Indian Islands.*

##### *Sunda Islands.*

Sumatra*	capital, Acheen or At-cheen.
Java .....	Batavia.
Borneo.....	Borneo.
Celebes .....	Macassar.
The Keys .....	chief island, Timor.

##### *Moluccas or Spice † Islands.*

Ceram ‡ LEADS 560 m. E. of Macassar.

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\* Sumatra is governed by three native kings besides the Dutch, who possess Padang and Bencoolen: this RUNS 420 m. S. of Malacca: and the English Singapore, a small WAY (8 m.) S. of Malaya. S. of Singapore is Banca, which possesses tin mines.

† More properly Moluccas or Royal Islands.

‡ South of Ceram is Amboyna, once famous for cloves, till



Bouro is NEAR 24 m. W. of Ceram.

Gilolo \* TAKES 170 m. N. of Ceram as you TURN 142 m. E. of Celebes.

*Philippine Islands.*

Luzon, capital Manilla.

Mindanao TAKES 170 m. S. by E. of Luzon.

Palawin, † as you TURN 142 m. is S. by W. of ditto.

THE (1000 m.) length of Sumatra is much more than the breadth, which TAKES 170 m.

Acheen does LIE (5 deg. long.) off the equator North, which RUNS 420 m.

Java VARIES (640 m.) little from the figure of a fish swimming westward.

TAKE (17 deg. long.) E. for Batavia, which RUNS 420 m. S. of the Equator.

The length of Borneo BEARS 840 m. from North to South, and VARIES 640 m. in breadth.

The city of Borneo is NEAR (24 deg. long.) E. of Malaya, and MILES 350 N. of the Equator.

Macassar GOES (30 deg. long.) E. of the South of Borneo, though it is MILES 350 S. of the Equator.

Manilla CUTS 710 m. E. of Cochin-China, and is governed by the Spanish, a people of courage and METTLE 31 deg. 15 deg.

*Remarks.*

Oceanica BOASTS 8010 m. in extent, and every where the palm is seen to wave its head over the waters.

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destroyed by the Dutch : S. E. of Amboyna are the Banda isles, famous for nutmegs.

\* Besides these are the islands of Ternati, Matir, Bakian, Tidore, Makian. The king of Ternati governs the other islands.

† Between these three islands are several small ones.

A chain of mountains passes through the island of Sumatra, and Mount Ophir is the chief, on the sides of which are Indian **TEMPLES** 13,950 ft.

Black sugar, called jaggari, is made in this island from the Anoo-palm.

The hippopotamus and rhinoceros are natives of this island.

Java signifies *great island*: at present it is divided into 3 kingdoms, viz. 1. The kingdom of Bantam; 2. The kingdom of Jocotra; 3. The kingdom of Cherribon. The Batavians trace their origin to a monkey, which they call woo-woo. The Dutch have several towns in the island, the chief of which is Batavia.

Borneo is the seat of a sultan, in whose dominions are elephants and buffaloes. The largest monkey tribe is found in this island: the pongo equals in size the human species, and the ourang-outang or simia satyrus inhabits the woods of the interior.

The battas, a savage race of cannibals, possess the interior of the country.

The Dutch have a fort near Bendermassin.

The inhabitants of the Philippine islands were made **SLAVES** in 1560 by the Spaniards: cocoa is the chief food of the inhabitants.

Trees, bearing exquisite spices, are diffused over the whole of the Moluccas: nutmegs and cloves are cultivated to great extent, the trade in which is chiefly in the possession of the Dutch: they possess also the ebony, sandal, and calambac trade. The Celebes, the country of cloves and nutmegs, produces the most poisonous of all vegetables, the upas, in the juice of which the Macassars dip their arrows. The Chinese first introduced the use of cloves and nutmegs, next the Persians, and lastly Europeans.



LESSON II.

*Continuation of Lesson I.*

*Australasia, including Australia.*

New Holland, chief settlement Swan River.  
New South Wales, capital Sidney.  
Van Dieman's Land, capital Hobart Town.  
New Guinea or Papua QUILTS 110 m. N. of New Holland.

New Britain is E. of Papua.

New Ireland is N. of New Britain, MILES 350 S. of the Equator.

Louisiade is S. E. of Papua.

Solomon's Isles lie S. E. WAYS 80 m. of New Ireland.

Queen Charlotte's Cluster TURNS 1420 m. E. of York Cape.

New Caledonia TENDS 1260 m. N. E. of Botany Bay.

New Hebrides, we NOTICE 217 m. N. E. of Caledonia.

New Zealand TENDS 1260 m. E. of Bass' Straits.

Norfolk Island is THE (1000 m.) N. E. of Port Jackson.

From Swan River we go through many NATIONS (2120 m. E.) to Botany Bay: Bass' Straits are the same distance S. of York Cape.

The Swan River colony live in HARMONY, 24 deg. 32 deg.

In Botany Bay the natives' DIET (61 long.) is MAIZE, 34 lat.

Hobart Town LEADS 560 m. S. by W. of Botany Bay.

QUITTING 1123 m. East of Botany Bay, we reach Cape North in New Zealand.

Cook's Strait TENDS 1260 m. E. of Hobart Town.

*Remarks.*

The natives of Australia have a complexion almost black: some of them have large heads, and in many respects resemble the ourang-outang. They paint red and white figures on their bodies.

The first vessel with settlers landed at Botany Bay under Governor Philip Sydney. Sidney, the capital, is 7 m. from the entrance of the bay called the head of Port Jackson, and stands upon a tributary of the river Hawkesbury, the chief river of the colony.

The country West of the Blue Mountains is well watered, and abounds in thick herbage.

Not FAR (94 m.) S. of New South Wales, separated from it by Bass' Strait, is Van Diemen's Land, which was discovered by Tasman, a Dutch navigator. In 1804 an establishment was removed from Bass' Strait to a place now called Hobart Town, the capital.

In 1811 the inhabitants of Norfolk Island removed from it, and part settled on the Derwent above Hobart Town, hence it is called New Norfolk, and the remainder in a fine district in the N. part of the island called Norfolk Plains, near the village of Launceston.

There are several mountains in the island of considerable elevation, the principal of which is called Table Mountain, RISING 4023 ft. behind Hobart Town. The climate of this island is well adapted to the English constitution. The chief rivers are the Derwent and Tamar.

New Guinea or Papua is inhabited by a woolly-headed Negro race, and it is the native country of the birds of paradise: the natives build their houses on rafts in the water. The island extends from 130 deg. to 150 deg. E. longitude, and lies between 1 deg. and 10 deg. S. latitude: the native

improves not his ESTATES (1 deg. 10 deg.), by TIMES (130 deg.) nor TOILS (150 deg.).

The natives of New Britain and New Ireland are VERNIAL (62 deg. 5 deg.).

The native of Solomon's Islands CASTS (70 deg. 10 deg.) a reflection on civilized man.

The natives of Queen Charlotte's Islands do not COVET ONE (71 deg. 12 deg.) comfort.

The natives of New Caledonia live in a CAVE or HUT (76 deg. 21 deg.).

New Zealand is governed by chiefs of a savage race, and of civilization quite BARREN (84 deg. 42 deg.)

New Zealand was discovered by Tasman in the year 1642, who describes the natives as of a brownish yellow complexion, with long black hair, resembling the Japanese. New Zealand consists of two islands: the northern island RUNS 420 m. N., and E. and W. WAYS 80 m.: the South island VARIES 640 m. from N. E. to S. W. The climate is mild, and the soil well adapted to cultivation: New Zealand is the native place of the bird called Poe, which has a beautiful tuft of white feathers, and a song more charming than that of any European species. No poisonous serpents are to be found here; and rats and dogs were the only quadrupeds which inhabited the island, the former of which served as an article of food, when Captain Cook visited it in 1770.

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### LESSON III.

#### *Continuation of Lesson II.*

##### *Eastern Archipelago or Polynesia.*

The Pelew Group RUNS 420 m. E. of Mindanao.

The Marians, 16 in number, are, they TELL us, 1550 m. E. of Manilla.

The Carolinas extend E. of the Pelews, as one TURNS 1420 m.

The Friendly Islands, LEADING 5623 m. N. W. of Cape Horn.

The Feejee Islands RUNS 420 m. W. of the Friendly.

Navigators' Group VARIES 640 m. N. E. Tongataboo.

The Society Islands we reach by TAKING 1723 m. E. by S. of Tongataboo.

Marquesas Group BEARS 840 m. N. E. of Otaheite.

Sandwich Isles, to which the vessel GLIDES 3560 m. W. of Mexico.

The RARE (44 deg. longitude) Islands of Pelew, are JUST 510 m. N. of the Equator.

We LEAVE (56 deg. longitude) the Equator for Guam, one of the Marians, that BEARS 840 m. N. of it.

We VIEW (68 deg. longitude) Hogoloo, the chief of the Carolines, which VARIES 640 N. of the Equator.

The inhabitants of Tongataboo WAR NOT (84 deg. 21 deg.) with the English.

At Maona the navigators fight and BATTER (81 deg. 14 deg.) each other.

Cook remained many DAYS (60 deg. longitude) at Otaheite, which TENDS 1260 m. N. of the Equator.

Marquesas Group LIES 50 m. South of the Equator, which VARIES 640 m. N.

In the middle of the North Pacific Ocean, between America and the Mulgraves, is the Sandwich Group. Owhyhee is the principal, of which Captain Cook says a DEAL (65 deg. longitude): this island is directly East of Mexico.

*Remarks.*

The inhabitants of the Marians, and Sandwich Islands, and Otaheite, and New Zealand, resemble each other, being copper coloured and long haired; they build their villages in groves of cocoa, banana, and bread-fruit trees. Their warriors wear an armour made of matting, which resists a pistol ball.

Captain Wilson was shipwrecked in the Pelew Islands in 1783.

The Marian Islands were discovered by Magellan, in LENT 1521, and were so called after Mary Ann of Austria: the only vegetables found were cocoa, orange, bread-fruit, and water lemon, but no quadrupeds before the time of the Spaniards. Magellan called these islands Ladrões, because the inhabitants were thieves,\* and stole his goods.

The Carolines are little known: the inhabitants of this group, as well as those of the former, resemble the natives of the Philippines.

The Friendly Islands consist of more than 100, the chief of which is Tongataboo, or the Consecrated Island: Coral rock appears to be the basis of the Island. The power of the King of Tongataboo is very great in these islands, and

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\* The island of Tinian is well cultivated, and produces cotton, sugar-cane, maize, indigo, and various fruits. Agaña, the capital of the island, has a battery of eight guns: the chief islands are Guan, Zarpane, Saipane: the group consists of sixteen islands, that make a chain which LEADS 560 from S. to N.



his fleet of war boats is more respectable than that of the King of Otaheite. The bread-fruit tree and Siam oranges are in great plenty here. The people of Tongataboo \* hold two great festivals, one to implore the protection of Footta-Faihi for the newly planted fruits : the other at the end of the harvest to testify the gratitude of the natives to the same Deity.

Maoona, the chief of the Navigators' Islands, is very fertile, and covered with cocoa, bread-fruit, banana, and orange trees : the groves are enlivened by the murmurs of numerous cascades. Women are handsome, and men above the ordinary size. At Oyolava is the largest village in the Polynesia. The seas of these islands are generally covered with boats, hence the term Navigators' Islands.

Otaheite, the chief island of the Society group, called the Queen of the Pacific Ocean, is composed of two conical mountains united by a marshy isthmus : the largest peninsula is 24 m. in diameter, the other 16 m.

All the vegetable productions of Oceanica are assembled in Otaheite, and of the best quality : here are eight sorts of bread-fruit, and fifteen of Banana.

The *Spondias Dulcis*, called Evi, in Otaheite, no where produces apples of a richer yellow or more delicious taste : the sugar-cane is much superior to that of the West Indies. The complexion of the natives is olive, a shade darker among the women than the Brunettes of Andalusia, in Spain.

Owhyhee, the chief of the Sandwich Islands, being 420 m. in circumference, was discovered by Captain Cook, and a native to kill him took his club of COCOA UP, 1779.

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\* MILES (350) S. of Tongataboo is the island of Vasques, which BEARS 840 m. N. E. of New Zealand.



The climate is more temperate than that of the American islands of the same latitude: the clouds are attracted by the mountains of Owhyhee, and the rain refreshes the interior. The productions of the island are potatoes, bread-fruit tree, bananas, cocoas, and the sugar-cane.

Hogs and poultry are found in abundance in the islands of Oceanica. Christmas Island TENDS 1260 m. S. of Owhyhee.

QUITTING 1123 m. S. W. we pass through a large group of islands as far as Pitcairn's Island: Pitcairn's island was colonized by part of the crew who mutinied against Captain Bligh, in the year 1789: they brought from Otaheite some women whom they had married, and then burnt the ship Bounty.

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## P R O B L E M S.

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*Definitions and Explanations of some Terms not alluded to in the previous Definitions.*

1. *Almacantars*, or parallels of latitude, are imaginary circles parallel to the horizon, and serve to shew the height of the sun, moon, or stars.

2. *Azimuth or vertical circles* are imaginary great circles passing through the zenith and the nadir, cutting the horizon at right angles.

3. The *prime vertical* is that azimuth circle which passes through the East and West points of the horizon.

4. *Amplitude* is the number of degrees that the sun or a star rises or sets from the East or West points of the horizon.

5. *The zenith distance* of a celestial object is the arc of a vertical circle, contained between the object's centre and the zenith, or it is what the altitude wants of 90 degrees.

6. *Hour circles* are the same as meridians.

7. The *Culminating Point* of a star or planet is that degree of its orbit which is most elevated.

8. *Climate* is a portion of the earth contained between two lesser circles parallel to the Equator, and of a breadth to make the longest day in the parallel nearest the Pole exceed the longest day nearest the Equator by half an hour.

9. *Antæci* are those people who dwell in the same degree of longitude, and in the same degree of opposite latitude. Equatorial inhabitants have no *Antæci*.

10. *Periæci* are those persons living in the same latitude but contrary longitudes; they have their days of the same length, but their hours opposite. Persons at the Pole have no *Periæci*.

11. *Antipodes* are those people of the earth who live diametrically opposite to each other. Walking with their feet opposite, and have their seasons, longitudes, and latitudes opposite to each other.

12. *Twilight* or *crepusculum* is that faint light which we notice before sun-rise, and after sun-set, which is occasioned by the rays of light being refracted in passing through the atmosphere, and reflected by the different particles thereof. It is usually computed to commence and terminate when the sun is 18 degrees below the horizon.

13. *Angle of Position* between two places on the earth is an angle at the zenith of one of the places, formed by the meridian of that place, and a vertical circle passing through the other, measured on the horizon from the elevated pole towards the vertical circle.

14. *Latitude* of a star or planet is its distance from the Ecliptic, measured upon the arc of a great circle perpendicular to it, either North or South.

N. B. The sun being always in the Ecliptic has no latitude.

15. *Longitude* of the sun or of a star is its distance from the first point of Aries reckoned in signs and degrees, commonly called the sun's place.

16. *Direct*. A planet is said to be direct when it moves according to the order of the signs, as from Aries to Taurus, &c.

17. *Retrograde* : an apparent motion of the planets in some parts of their orbits ; when they seem to go contrary to the order of the signs.

18. *Stationary* : a planet is said to be stationary when it has no apparent motion.

19. *Geocentric* place of a planet is its position as seen from the earth.

20. *Heliocentric* place of a planet is its position as it would be seen by a spectator in the sun.

21. *Precession of the Equinoxes*, a term denoting that very slow motion by which the Equinoxes change their places westward, contrary to the order of the signs. Hence all the constellations have changed the places assigned them by the ancient astronomers. In the time of Hipparchus and the oldest astronomers, the first stars of Aries and Libra were fixed for the Equinoctial points, but these stars are now placed upon our globes more than a whole sign East of those points.

22. *Disk*, the face of the sun or moon, as presented to a spectator on the earth, having the appearance of a circular plane, though they are really spherical bodies.

23. *Digit*, the twelfth part of the sun's or the moon's apparent diameter.

24. *Aspect* of the planets, is their position with respect to each other : of these there are five, viz.

♄ Conjunction, when they are in the same sign and degree.

\* Sextile, when they are  $\frac{1}{3}$  of a circle or two signs distant.

□ Quartile, when three signs or 90 degrees apart.

△ Trine, when four signs from each other.

♁ Opposition, when they are six signs apart, or half a circle.

- ☉ Sign of the sun.
- ☾ Sign of the moon.
- +
- 
- ×
- ÷
- =

Since every part of the earth describes a circle, and passes over 360 degrees in 24 hours, it follows that it passes over  $\frac{1}{24}$ th of 360 degrees in one hour, or 15 degrees; and since it passes over 15 degrees in one hour or 60 minutes, it goes through a space of one degree in four minutes of time; therefore, to turn degrees into time, divide the degrees by 15, and the quotient will be hours, and multiply the remainder by four, the product will be minutes of time. Example: turn 47 degrees into time,  $47 \div 15 = 3$  and 2 over;  $2 \times 4 = 8$  minutes, hence  $47 \text{ deg.} = 3 \text{ hours } 8 \text{ minutes of time.}$

Turn into Time the following degrees:

Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
15	62	101	321	41	310
30	79	106	176	70	127
45	14	72	109	243	122
75	69	58	317	360	247
90	73	64	162	102	99
39	108	73	236	201	350
42	170	17	147	146	222
64	164	36	136	227	140
36	132	121	217	333	309
24	114	173	212	178	59
37	111	192	194	27	264
21	120	227	149	150	175

*To turn minutes of a degree into time.*

**RULE**—Divide the minutes of a degree by 15, for the

minutes of time, and if there be a remainder multiply it by 4 for the seconds of time.

Ex. Reduce 48 minutes of a degree into time.

$$15 \overline{) 48}$$

Min. 3, sec. 12.

Turn the following minutes of a degree into time :

Min. of a Deg.	Min. of a deg.	Min. of a Deg.	Min. of a Deg.	Min. of a Deg.	Min. of a Deg.
35	38	29	57	41	16
43	52	42	40	24	25
26	47	34	39	37	14
54	22	27	36	50	44
49	31	17	51	32	30

*To turn hours and minutes into degrees.*

RULE 1. Multiply the hours by 15, and the product will be degrees; then divide the minutes by 4, and the quotient will be degrees; if there be any remainder multiply it by 15, and the product will be minutes of a degree.

Ex. Turn 6 hours 27 min. into degrees.

$$6 \times 15 = 90 \text{ deg.}$$

$$27 \div 4 = 6 \text{ 45.}$$

$$\underline{96 \text{ 45.}}$$

Turn the following into degrees.

Ho.	Min.	Ho.	Min.	Ho.	Min.	Ho.	Min.	Ho.	Min.
3	0	2	58	8	47	19	16	17	12
7	20	16	35	15	15	2	17	23	7
4	53	21	3	12	5	4	15	14	45
3	27	10	40	13	36	9	11	16	20
5	14	4	30	18	17	3	12	12	48
5	39	20	19	9	34	17	3	17	5
11	27	23	9	10	27	17	14	16	13
15	26	14	23	7	52	13	2	3	16



## PROBLEM I.

*The Time being given at any particular Place to find what Time it is at any other Place.*

**RULE.** Find the difference of longitude\* between the two places, and turn it into time, by allowing 15 degrees to an hour, or four minutes of time to one degree; then if the place of the required time be East of the given place add the difference of time to the hour of the given place: but if West subtract it.

**Ex.** When it is six o'clock in the evening at Paris, what time is it at Calcutta?

Longitude of Paris 2 deg. E.

Longitude of Calcutta 88 deg. E.

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86=5 hours 44 minutes.

Time of Paris 6 hours — minutes P. M.

5 hours 44 minutes.

Time at Calcutta 11 hours 44 minutes P. M.

4 P. M. at London .. What is the time at Mexico?

2 A. M. .. Mecca?

6 A. M. at Amsterdam Philadelphia?

2 P. M. at Bern .... Pekin?

5 P. M. at London .. Gibraltar?

7 A. M. .. Ispahan?

2 P. M. .. Presburg?

9 A. M. at Petersburg New York?

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\* To find the difference of longitude between two places, if the places be situated in the same hemisphere subtract the less from the greater longitude; if in opposite hemispheres add their longitudes together to find the difference; but if their amount exceed 180 degrees, subtract that amount from 360 to ascertain their difference.

- 4 P. M. at Stockholm, What is the time at Constantinople?  
 5 A. M. at Teneriffe.. Jamaica ?  
 8 A. M. at Naples .. Lisbon ?  
 11 A. M. at Bagdad .. Washington ?
- 

## PROBLEM II.

*A particular Place being given, and the Hour of the Day, to find all Places where it is then Noon, or any other given Hour.*

**RULE.** Convert the difference of time between the two places into longitude, then take so many degrees E. or W. of the given place, according as the time is before or after noon.

**Ex.** When it is two o'clock in the morning at Mexico, where is it two o'clock in the afternoon ?

Mexico is 101 deg. of W. longitude or 11 deg. upon the second quadrant W. longitude.

Difference of time is 12 hours=180 deg. W., or 79 deg. on the first quadrant of E. longitude, gives the longitude of the places required—Delhi, Ladak, Cashgar, and Western Siberia.

Given Place.	Time.	
Madrid.....	4 P. M.	Where is it 7 A. M. ?
Brussels .....	2 P. M.	4 P. M. ?
Petersburg .....	7 A. M.	3 P. M. ?
Warsaw .....	3 P. M.	12 A. M. ?
Lisbon.. .....	3 A. M.	7 A. M. ?
Havannah .....	2 P. M.	5 A. M. ?
Philadelphia.....	4 P. M.	1 P. M. ?

St. Helena	....	12 A. M.	Where is it	5	P. M. ?
Mecca	.....	3 P. M.		7	A. M. ?
Gibraltar	.....	7 P. M.		3	P. M. ?
Ceylon	.....	5 A. M.		1	P. M. ?
Rome	.....	8 A. M.		3	P. M. ?

Time and Place given.

2	P. M.	at Rome,	Where is it	7	A. M. ?
3	P. M.	Madras,		6	A. M. ?
7	A. M.	London,		2	P. M. ?
5	P. M.	.....		3	A. M. ?
4	A. M.	.....		12	A. M. ?
6	A. M.	Madrid,		10	A. M. ?
7	P. M.	Calcutta,		5	A. M. ?
9	A. M.	London,		12	P. M. ?
		.....		4	P. M. ?
		.....		7	A. M. ?
		.....		3	A. M. ?
4 $\frac{1}{3}$	P. M.	Ispahan,		12	A. M. ?
3 $\frac{1}{3}$	A. M.	Constantinople,		4	P. M. ?
7	P. M.	Petersburg,		3	A. M. ?
9	P. M.	Berlin,		12	P. M. ?
1	P. M.	Bern,		6	P. M. ?
8	P. M.	Stockholm,		5	A. M. ?
9	A. M.	Copenhagen,		3	P. M. ?
2	A. M.	Paris,		11	P. M. ?
3	P. M.	Edinburg,		6	A. M. ?
7	P. M.	.....		12	A. M. ?
12	P. M.	.....		7	A. M. ?
4	P. M.	Milan,		1	A. M. ?
12	A. M.	St. Helena,		4	P. M. ?
5	P. M.	Mecca,		10	A. M. ?
8	A. M.	Buenos Ayres,		7	P. M. ?

March 15th, 44 B. C., Cæsar was assassinated at Rome. When 4 P. M. there, where was it then 1, 2, 4, 7, and 11, A. M.; 3, 5, 7, 9, 11. P. M.?

At 7 P. M. at Petersburg, where Peter the Great expired, January 29th, 1725, where was it then noon; what places had the sun 45 deg. East of them; and what season had the Cape of Good Hope?

At 2 P. M. at Havannah, which was taken by the English, August 12th, 1762, the day on which his late Majesty, George IV., was born, what was then the time at 104 deg. E. of London; 70 deg. E. of Havannah; and whether had the inhabitants of Pekin the sun East or West of them at that time?

At 10 A. M. at London, a ship being upon the same parallel of lat., 50 deg. W., required the time with her, and how many miles from London at  $37\frac{3}{4}$  miles to a degree of long.?

### PROBLEM III.

*To find the Sun's Longitude or place in the Ecliptic.*

**RULE.** Find how many days\* the sun has been in the sign corresponding to the required day, then add to or take from them according to the following scale, and the sum or difference will be the sun's longitude or place in the ecliptic.

The degrees which the sun continues in each sign of the Zodiac are equal, but the time that the sun continues in each is not equal, for the sun continues in the spring signs

\* Each day is accounted as one degree of longitude.

92 days, in the summer signs 94 days, in the autumnal signs 90 days, and in the winter signs 89 days, making an excess of six days more than the degrees in the spring and summer signs, and an excess of one degree more than the days in the autumnal and winter signs, as in the following scale :

*Aries*, nothing added or deducted from the days.

*Taurus*, 1 deducted from the days.

*Gemini*, 1 Ditto.

*Cancer*, 2 Ditto.

*Leo*, 1 Ditto.

*Virgo*, 1 Ditto.

For the autumnal signs there is no deduction or increase to make, and in the winter signs there is only one degree to be added to the days during the time the sun continues in Capricornus.

The sun enters the signs of the Zodiac \* on the following days :

*Spring Signs.*

♈ Aries, March 21.

♉ Taurus, April 20.

♊ Gemini, May 21.

*Summer Signs.*

♋ Cancer, June 21.

♌ Leo, July 23.

♍ Virgo, August 23.

*Autumnal Signs.*

♎ Libra, September 23.

♏ Scorpio, October 23.

♐ Sagittarius, November 22.

*Winter Signs.*

♑ Capricornus, Dec. 22.

♒ Aquarius, January 20.

♓ Pisces, February 19.

*Ex.* What is the sun's longitude on May 1 ?

The sun entered Taurus April 20, it then had ten more

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\* For the method of remembering these signs see figure, p. 152.

days to continue in April and one day in May, which makes the sun's longitude 11 days or 11 degrees in Taurus.

What is the sun's place on the following days :

March 24, April 2, May 5, June 6, July 14, August 7, September 12, October 20, November 4, December 17, January 25, February 20, March 11, June 19, May 24, October 1, January 2, July 27, April 14? October 25th, 1415, was fought the memorable battle of Agincourt; what was then the sun's place; at 4 A. M. at London what places had then noon; what hour had a place 40 deg. W.; and what season had the inhabitants of Chili?

November 1, 1755, Lisbon greatly suffered from an earthquake; required the sun's place on that day, the time at Lisbon when 2 P. M. at London, and the complement\* of latitude of Lisbon?

March 21, 1556, Archbishop Cranmer was burnt at Oxford; what was the sun's place, which pole was then enlightened, and on what day of the month would the sun be 180 deg. from that place?

June 12, 1381, Wat Tyler assembled some rebels on Blackheath; required the sun's place, how far he was from the summer solstice, and when the sun was 70 deg. E. what was the time at Blackheath?

*To find when the Sun will have a given Longitude.*

As the sun passes over one degree of the Ecliptic daily, the day on which he will have a given longitude may be easily found by reckoning one degree for each day.

*Ex.* On what day of the year will the sun have 14 deg. in Aries?

The sun entered Aries March 21, and then had ten more

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\* Complement of latitude is what the latitude wants of 90 deg.



days to continue in March, and 4 deg. or four days in April, therefore it is April 4th.

1666, when the sun had 10 deg. in Virgo, commenced the fire of London; required the day of the month, how many degrees the sun was from the first degree of Aries, and from the Autumnal equinox; and did the sun set before or after six on that day?

In latitude 31 deg. N., and in long. two hours East of London, when the sun was 9 deg. in Leo, 1798, was gained a renowned victory by Admiral Nelson; required the place, the day of the month, the bearing of the place from London, and what is the time there when it is 2 P. M. at Lisbon?

Died, near Seville, 1554, when the sun was 10 deg. in Scorpio, Cortez, one of the greatest monsters that ever disgraced power; what was the day of the month, and at 5 P. M. at Seville, 6 deg. W., where was it then 10 A. M.?

### *The Declination of the Sun.*

Def. Declination of the sun, moon, or stars, is their distance from the Equinoctial, North or South. When the sun is on the Equinoctial, he has no declination, and enlightens half the globe from pole to pole. As he increases in North declination, he gradually shines farther over the North Pole, and leaves the South Pole in darkness: and in the same way when he has South declination, he shines beyond the South Pole, and leaves the North Pole in darkness. The annexed figure will shew the sun's increase of declination in each sign, and the daily increase of one degree:



In consequence of this variation in the inclination of the Ecliptic, the sun's increase of declination in Spring and Autumn is the same, and in Summer and Winter the sun's decrease of declination is the same. This increase and decrease vary much in each sign, thus:

## Spring.

In Aries the sun increases  $11\frac{1}{2}$  deg.

Taurus ditto  $8\frac{3}{4}$

Gemini ditto  $3\frac{1}{4}$

## Summer.

In Cancer the sun decreases  $3\frac{1}{4}$  deg.

Leo ditto  $8\frac{3}{4}$

Virgo ditto  $11\frac{1}{2}$

In the above scale we observe the sun's increase and decrease of declination in the same ratio taken from the Tropics, consequently it is obvious that to obtain a rule for any three signs, a rule is given for all the others. The sun's increase of declination in Aries is very regular, being 4-10ths of a degree daily.

**RULE I.** *For Aries, Pices, Virgo, and Libra.*

Multiply the number of days the sun has been in any of these signs by ,4, and the product is the sun's increase or decrease\* of declination in any of the above signs.

N. B. Should the pupil not be conversant with decimals, instead of multiplying by ,4—multiplying by 4 and dividing the product by 10, will give the same result.

The sun's increase of declination in Taurus is 3-10ths of a degree daily.

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\* The sun decreases in declination in Virgo and Pisces, therefore the decrease of the sun's declination must be taken from the declination on entering the sign.

**RULE II.** *For Taurus, Scorpio, Leo, and Aquarius.*

Multiply the number of days the sun has been in any of these signs by ,3, and the product added to the sun's declination on entering the sign, if the sun be increasing in declination; or taken from the declination on entering the sign if decreasing in declination.

The sun's daily increase of declination in Gemini is very irregular, being 15-100ths for half the days he continues in the sign, but during the other 15 days (the last part of the sign) only 5-100ths.

**RULE III.** *For Gemini, Cancer, Sagittarius. and Capricornus.*

Multiply the number of days during the first 15 days the sun has been in any of these signs by ,15, and during the last 15 days by ,05, and add the product (if the sun be increasing in declination) to the sun's declination at the commencement of the fraction; but if decreasing in declination, subtract it for the declination required.

*Sun's Declination on entering the Signs.*

	Deg.		Deg.
Aries,	0	Libra,	0
Taurus,	$11\frac{1}{2}$	Scorpio,	$11\frac{1}{2}$
Virgo,	$11\frac{1}{2}$	Pisces,	$11\frac{1}{2}$
Leo,	$20\frac{1}{4}$	Aquarius,	$20\frac{1}{4}$
Gemini,	$20\frac{1}{4}$	Sagittarius,	$20\frac{1}{4}$
Part 2d,	$22\frac{2}{3}$	Part 2d,	$22\frac{2}{3}$
Cancer,	$23\frac{1}{2}$	Capricornus,	$23\frac{1}{2}$
Part 2d,	$22\frac{2}{3}$	Part 2d,	$22\frac{2}{3}$

1. Aries confined in an AREA.—AREA ,4, daily increase of declination.

2. Taurus called TITAN \* in a past AGE.

TITAN  $11\frac{1}{2}$  deg., the sun's declination on entering the sign; AGE, 3 daily increase of declination.

3. Gemini, powerful as a HOST, was killed by AQUILA, HOST  $20\frac{1}{4}$  deg., the sun's declination on entering the sign; AQUILA, 15 daily increase of declination.

*Last Part.* Gemini per ANNUM is lighted by SOL. ANNUM  $22\frac{3}{4}$  deg., the sun's declination when the second fraction commences.

SOL, 05 daily increase of declination during the last 15 days.

Ex. What is the sun's declination on April 4?

The sun has been 14 days in Aries, then  $14 \times, 4 = 5, 6$  deg. the sun's declination.

What is the sun's declination May 5?

The sun has been 15 days in Taurus, then  $15 \times, 3 = 4, 5$  deg.  $= 4\frac{1}{2}$  deg.; and the sun's declination on entering the sign is  $11\frac{1}{2}$  deg., consequently  $11\frac{1}{2} + 4\frac{1}{2} = 16$  dec.

What is the sun's declination on the following days: May 20, July 7, April 20, June 1, July 4, Sept. 26, Aug. 9, Oct. 28, Nov. 10, Dec. 30, Jan. 24, July 27, March 30, Feb. 2, Nov. 29?

In 1790, when the sun had been 27 days in Aries, died, at Philadelphia, 75 deg. W. and 40 deg. N., the philosopher Franklin: required the day of the month, the sun's declination on that day, the difference of time between London and Philadelphia, and how many degrees the sun was from the zenith of Philadelphia when upon its meridian?

The day and declination of the sun are required, when the

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\* Titan, the name of Taurus among the Egyptians.

sun was 14 deg. in Cancer, being the day in 1100 when Jerusalem was taken by the Crusaders.

Aug. 18, 1502, the island of St. Helena, 5 deg. W. 16 deg. S., was discovered; what was the sun's declination, to what countries was he vertical\* on that day, and what inhabitants had the sun in their zenith at 9 A. M. at London?

When the sun was 2 deg. in Scorpio and 45 deg. E. of the meridian of London, what were the day of the month, the sun's declination, the hour at London, and what inhabitants of the earth had then no shadow?

Required the sun's declination on the following days:

March 21	July 14
April 4	Oct. 19
May 21	Sep. 1
June 21	August 11
July 3	June 17
August 23	April 10
Sep. 23	Dec. 14
Oct. 7	Feb. 18
Nov. 4	Oct. 1
Dec. 22	August 30
Jan. 20	May 3
Feb. 7	Nov. 20

May 3, 1495, the island of Jamaica was discovered by Christopher Columbus; required the declination of the sun on that day, whether the inhabitants of Peru had their shadows northward or southward, and how far the sun was from the zenith of Lima when it was noon there?

June 18, 1815, was fought the battle of Waterloo, long.

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\* The sun is vertical to all places when the latitude is equal to the sun's declination.



4 deg. E.; required the sun's declination, whether the time was before or after the time at London, and how much; and how many degrees the sun was from the zenith of Waterloo at noon?

## PROBLEM V.

*To find the Meridian Altitude\* of the Sun.*

RULE. Find the sun's declination on the given day by Prob. IV., then add it to the complement of the latitude, if the declination and the latitude are of the same name, but if contrary, subtract the declination from the complement of latitude, and the sum or difference will be the meridian altitude required.

Ex. What is the sun's meridian altitude at London May 26?

By Prob. IV. the sun's declination is  $20\frac{1}{4} + \frac{3}{4} = 21$  deg. N., then  $21 + 38\frac{1}{2}$  deg. complement of lat.  $= 59\frac{1}{2}$  deg. the sun's meridian altitude.

What is the sun's meridian altitude at the following places on the proposed days: at Lisbon, 39 deg. N. March 29; London,  $51\frac{1}{2}$  deg. N. May 17; Naples, 41 deg. N. June 6; Paris, 49 deg. N. July 12; Malta, 36 deg. N. Nov. 14; Cape Town, 31 deg. S. Dec. 7; Cape Farewell, 60 deg. N. Aug. 26; Lima, 12 deg. S. May 10; London, March 1, April 20, May 14, Oct. 11, and Aug. 8?

A ship in lat. 14 S., and long. 2 hours W. of London, sailed due North 1440 miles; required what lat. she was

\* Altitude is the height of a heavenly body above the horizon.

in, and what would be the sun's meridian altitude in that lat. on May 30 ?

At a certain place, where the clocks are two hours faster than at London, the sun's meridian altitude was 30 deg. to the South on that day in spring when the sun had no declination ; required the latitude\* and place, and the day of the month ?

A ship was at sea, 10 hours W. of London, on April 20th, when at noon it was observed that every object which was perpendicular on deck, cast a shadow† equal in length to its height ; required what latitude she was in, what was the time at Lisbon 9 deg. W., and the sun's longitude.

## PROBLEM VI.

*To find those Places on the Earth where the Sun is Vertical at any given Hour.*

**RULE.** Find the declination of the sun, which is the latitude of the place required, then turn E. or W. of the given place so many degrees as are equal to the time before or after noon.

\* When the sun's meridian altitude and the day of the month are given to find the latitude, take the declination of the sun from the meridian altitude to give the complement of latitude, when the declination and latitude are of the same name, but if of contrary names, add them together, to give the complement of latitude: the complement of latitude taken from 90 deg. gives the latitude required.

† When the sun is 45 deg. above the horizon of any place, every object which is perpendicular casts a shadow equal in length to its height.

**Ex.** Where is the sun vertical at 44 minutes past 6 o'clock in the evening at London May 20th ?

ho. min. deg. deg. deg.

6 44 = 90 + 11 = 101 W. long. of the place required.

The sun's declination, Rule IV., equals 20 deg. N. lat. of the place.

Mexico has 101 deg. W. long. and 20 deg. N. lat., and consequently the sun is vertical to Mexico at that time.

Find where the sun is vertical on the following days and hours :

May 1, 9 A. M.	August 20, 4 A. M.
Aug. 7, 2 P. M.	Feb. 19, 12 P. M.
Sept. 20, 4 P. M.	March 1, 8 A. M.
Nov. 17, 8 P. M.	June 21, 7 A. M.
Sept. 14, 9 A. M.	May 20, 6 A. M.
July 26, 10 P. M.	June 1, 4 A. M.

June 26, 1541, Pizarro was assassinated at Lima 76 deg. W. 12 deg. S. at 4 P. M. at London ; what was the time at Lima ; where was the sun then vertical ; what season had the inhabitants of Peru ; which pole was then enlightened ; and how many degrees would the rays shine beyond\* the pole ?

In the latitude of London, 37 miles make one degree of longitude ; suppose a person were to travel due East from

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\* Rays of light are projected in right lines, and the sun's rays always enlighten half of the globe at a time ; therefore when the sun is vertical to the Equator, his rays extend to both poles, or 90 degrees every way from the Zenith ; consequently when the sun has one degree of declination North, he shines one degree beyond the North Pole, and when 23½ deg. N. dec. he shines 23½ deg. beyond the pole : this is the cause of the arctic and the antarctic circles.

London for 90 days at 50 miles per day, what would then be his longitude? How many degrees would the sun be from the Zenith when noon in that longitude, and to what place vertical if he completed his journey on April 20th?

A person is situated in lat. 51 deg. N. on May 1; required how many miles he must travel South that the sun may be vertical to him at noon, and how many miles North, that he may see the sun at the horizon at midnight?

On March 29th, when the sun had passed the meridian of London 5 hours, to what place was he then vertical, and at what place in North lat. were the shadows of perpendicular objects the same length as their height?

### PROBLEM VII.

*When it is Midnight at any place in the Temperate or Torrid Zones, to find the Sun's Altitude at any place, on the same Meridian, in the North Frigid Zone, where the Sun does not set.*

**RULE.** Take the complement of the latitude of the place in the Frigid Zones from the sun's declination, and the difference will be the sun's altitude.

May 29th, when it is midnight at Petersburg, what is the sun's altitude at North Cape 72 deg. N.?

$90 - 72 = 18$ , complement of lat.

The sun's dec. May 29th, is  $21\frac{1}{4}$  deg. N., then  $21\frac{1}{4} - 18 = 3\frac{1}{4}$ , altitude of the sun at midnight.

When it is midnight at Buenos Ayres, in what lat. must a ship be South, to have the sun 5 degrees above the horizon?

Nov. 30th, when it is noon at New Orleans and at Yucatan, where is it then midnight, and in what lat. must a ship be in the southern ocean to have the sun 2 degrees above the horizon ?

### PROBLEM VIII.

*Given the Sun's Meridian Altitude and the Day of the Month, to find the Latitude of the Place.*

**RULE.** If the sun's declination and the latitude be of the same name, take the declination of the sun from the sun's altitude, and the difference will be the complement of lat. ; but if of a contrary name, add the sun's declination to his altitude for the complement of lat., which taken from 90 deg. will give the latitude required.

At noon, May 10th, the sun was observed to be 60 deg. above the horizon ; required the latitude.

May 10, the sun's dec. is  $17\frac{1}{2}$  N.

Then  $60 - 17\frac{1}{2} = 42\frac{1}{2}$ , comp. of lat.

$90 - 42\frac{1}{2} = 47\frac{1}{2}$  lat. required.

A ship in the Atlantic Ocean had it noon 4 hours after London, and the sun had 64 deg. of altitude on March 31 ; required her lat. and long.

Sept. 13, 1759, in long. 71 deg. W., when the sun's meridian altitude was 50 deg., was killed a renowned General, who closed his career with victory ; required the place, its latitude, and the name of the General.

A ship sailed from  $51\frac{1}{2}$  deg. N. lat. upon the meridian of  $5\frac{1}{2}$  deg. W., the distance of 4050 miles ; required what place she would arrive at, and the sun's altitude at that place Oct. 7.



The inhabitants of Cape Town observed the sun to be 71 deg. above the horizon at noon on Dec. 2; required the latitude, and whether the sun would be North or South of them at noon.

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## PROBLEM IX.

*A Place being given in the Torrid Zone to find those two Days of the Year on which the Sun will be Vertical to that Place.*

**RULE.** Find the day of the month on which the sun has the same declination as the latitude of the given place, then find the day the sun will have the same declination on the other side of the solstice, and these will be the two days required.

*Ex.* On what days of the year will the sun be vertical to Benin, lat. 6 deg. N. ?

By Prob. IV. the sun's declination is 6 deg. N. on April 15, and Sept. 8.

On what two days of the year will the sun be vertical to the following places : St. Helena, 16 deg. S. ; Mocha, 16 deg. N. ; Lima, 12 deg. S. ; Jamaica, 18 deg. N. ; Tombuctoo, 17 deg. N. ; Pondicherry, 12 deg. S. ?

Suppose a person to travel eastward upon the Equator for 8100 miles, and then northward 360 miles ; required at what islands he would arrive, and on what two days of the year the sun would be vertical to those islands.

On what two days of the year will the sun be vertical to that place, from the zenith of which the sun will be distant  $31\frac{1}{2}$  deg. on Dec. 21, and its time is 48 minutes later than that at London ?



## PROBLEM X.

*The Month and Day of the Month being given, at any Place in the Torrid or Temperate Zones, to find what other Day of the Year is of the same Length.*

RULE. Find the declination of the sun on the given day, then find the day that the sun has the same declination on the other side of the nearest solstice, and it will be the day required.

Ex. What day of the year will be of the same length as the 25th of April?

The sun's declination on the 25th of April is 13 deg. N. Then it will be found to have the same declination on the 13th of August.

What other days will be of the same length as the following: May 12, June 1, Nov. 7, Oct. 20, Dec. 1?

August 2, 1100, William Rufus was shot in the New Forest; required what other day will be of the same length to the inhabitants South of the Equator?

## PROBLEM XI.

*To find when constant Day commences in the Frigid Zones.*

RULE. Take the complement of the latitude of the given place, and then find the day on which the sun has the same declination, which will be the declination of the sun when constant day begins.

Ex. When will constant day commence in the island of Spitsbergen?

Lat. 78 deg. N. Complement of lat. = 12 deg. the de-

clination of the sun on the day required: the sun has 12 deg. declination, April 22, the time at which constant day begins.

When will constant day begin in latitude 73 deg. N.? When will constant day commence at that place which is 4800 miles from the Equator and 20 deg. E. of London?

## PROBLEM XII.

*To find the Length of the Longest Day\* in the Frigid Zones.*

**RULE.** Find the two days of the year on which the sun has the same declination as the complement of the latitude, then the number of days between these two days is the length of the longest day in the Frigid Zones.

**Ex.** What is the length of the longest day at Spitzbergen?

The two days on which the sun has the same declination as the complement of latitude are April 5th and September 8th, the days between are 156 days, the length of the longest day at Spitzbergen.

What is the length of the longest day in lat. 70 deg. N., in 67 deg. N., 74 deg. N., 83 deg. N., and in 88 deg. N.?

Melville Island, long. 111 W., lat. 75 N.; here, in 1820, Captain Parry and his crew wintered; required the longest day and the longest night, and how many degrees the sun is from the zenith of that place at the winter solstice.

\* The length of the longest night at any place is equal to the longest day of the opposite season, and the sun becomes absent to any place whose complement of latitude is equal to the declination of the sun.

## PROBLEM XIII.

*To find on what Day of the Year the Sun will have a given Declination.*

**RULE.** Find to which sign the declination of the sun belongs, and how many degrees the sun has increased or decreased in the sign; this divided by the fraction of the sign will give the number of days the sun has been in the sign.

**Ex.** When will the sun have 16 deg. N. declination?

The sun has been 15 days in Taurus, and it had  $11\frac{1}{2}$  deg. declination when it entered; then  $16 \text{ deg.} - 11\frac{1}{2} \text{ deg.} = 4\frac{1}{2}$  in Taurus and Virgo;\* then  $4.5 \div .3 = 15$  days after 20th of April or the 5th of May, and the 8th day of August.

On what days of the year will the sun have declination as follows; 10 deg. N., 17 deg. N., 20 deg. N., 4 deg. S., 14 deg. S., 4 deg. N., 7 deg. S., 8 deg. N., and 23 deg. S.?

## PROBLEM XIV.

*Any number of Days, not exceeding 186, being given, to find the Parallel of North Latitude in which the Sun does not set during that Time.*

**RULE.** Take half the number of days, and it will be the sun's distance from the solstice; then find the sun's declination corresponding to the day of the month, on which

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\* As the degrees in Taurus are reckoned from the Equinox, so must the degrees in Virgo.

the sun is half the number of days distant from the solstice, and it will be the complement of the parallel required.

Ex. In what parallel of latitude does the sun not set during 156 days?

$\frac{156}{2} = 78$  days from the solstice, or 15 days from Aries and Libra, answering to the 5th of April, and the 8th of September; on which days the sun has 12 deg. N. declination, the complement of the latitude required, or 78 N. lat.

In what parallels does the sun not set during the following number of days: 74, 100, 10, 46, 140, 16, 30, 150, 4, and 28?

An inhabitant of St. Helena wishing to enjoy the rays of the sun in the northern hemisphere for 50 days without intermission, required how many miles he must travel from St. Helena, and how many miles he must travel south to have the same advantage in the southern hemisphere.

#### PROBLEM XV.

*To find the Beginning, End, and Duration, of constant Twilight at any Place in the Frigid Zones.*

RULE. Take the complement of latitude, and, if the place be in north latitude, find on what two days of the year the sun will have south declination equal to the complement of latitude: \* the number of days between these

\* When the sun's declination south is equal to the complement of north latitude, constant twilight commences, and continues until the sun has 18 deg. of south declination below the declination corresponding to the complement of latitude.

two points of the Ecliptic will be the length of constant twilight.

Ex. When will constant twilight commence at North Cape 72 deg. N., and how long will it continue?

90 deg.—72 deg.=18 deg. complement of lat.

The sun will have 18 deg. S. on May 12th, when constant twilight commences, and as the sun's declination is never more than  $23\frac{1}{2}$  deg., the sun cannot descend more than  $5\frac{1}{2}$  S. of 18 deg.\* and the sun will have 18 deg. S. declination on July 31; consequently twilight continues 80 days.

What are the beginning, end, and duration, of constant twilight in the following latitudes: 74 deg. N., 80 deg. N., 79 deg. N., and 84 deg. N.?

#### PROBLEM XVI.

*To find the number of Days the Sun rises and sets in the Frigid Zones.*

RULE. The sun will continue to rise and set to any place in the Frigid Zones from the time the sun has declination in the opposite hemisphere equal to the complement of the latitude of the given place, to the time he has declination in the same hemisphere equal to the complement of the latitude.

Ex. How many days will the sun continue to rise and set at the North Cape, in the island of Maggeroe, in lat. 72 deg. North?

\* When the sun is 18 deg. below the horizon twilight ends.

90 deg.—72 deg.=18 deg. complement of lat.

The sun will continue to rise from January 27th to May 12th, and from 31st of July to the 14th of November; making in the first period 105, and in the latter 106, which together equal 211 days.

Find the number of days that the sun continues to rise and set in the following latitudes: \* 64 deg. N., 79 deg. N., 80 deg. N., 84 deg. N., and 69 deg. N.

### PROBLEM XVII.

*To find in what Climate any given Place is situated.*

**RULE.** Find, according to the following table of climates, the climate corresponding to the given latitude.

Clim.	Time	Width	Latitude.	Climate	Width	Lat.
1.	min. 15	$8\frac{1}{2}^{\circ}$	$8\frac{1}{2}^{\circ}$	13.	$1\frac{1}{2}^{\circ}$	$60^{\circ}$
2.	30	$8\frac{1}{2}$	$16\frac{3}{4}$	14.	$1\frac{1}{4}$	$61\frac{1}{4}$
3.	45	$7\frac{1}{2}$	$24\frac{1}{4}$	15.	$1\frac{1}{4}$	$62\frac{1}{2}$
4.	60	$6\frac{1}{2}$	$30\frac{3}{4}$	16.	1	$63\frac{1}{2}$
5.	hrs. $1\frac{1}{4}$	$5\frac{3}{4}$	$36\frac{1}{2}$	17.	$\frac{3}{4}$	$64\frac{1}{4}$
6.	$1\frac{1}{2}$	5	$41\frac{1}{2}$	18.	$\frac{1}{2}$	$64\frac{3}{4}$
7.	$1\frac{3}{4}$	4	$45\frac{1}{2}$	19.	$\frac{1}{2}$	$65\frac{1}{4}$
8.	2	$3\frac{1}{2}$	49	20.	$\frac{1}{2}$	$65\frac{3}{4}$
9.	$2\frac{1}{4}$	3	52	21.	$\frac{1}{4}$	66
10.	$2\frac{1}{2}$	$2\frac{1}{2}$	$54\frac{1}{2}$	22.	$\frac{1}{4}$	$66\frac{1}{4}$
11.	$2\frac{3}{4}$	$2\frac{1}{4}$	$56\frac{1}{2}$	23.	$\frac{1}{4}$	$66\frac{3}{4}$
12.	3	$1\frac{3}{4}$	$58\frac{1}{2}$	24.	0	$66\frac{3}{4}$

\* The sun will rise and set the same number of days in equal latitudes, whether in the North or South Frigid Zone.



The widths of the climates may be remembered in this manner: 4 climates make a difference in the time of the sun's setting of one hour, consequently each climate makes a difference of 15 minutes, according to the arrangement of the foregoing table.

The widths of the first four climates are equal to one hour, viz.  $8\frac{1}{2}$  deg.,  $8\frac{1}{4}$  deg.,  $7\frac{1}{2}$  deg.,  $6\frac{1}{2}$  deg. =  $30\frac{3}{4}$  deg. = 1 hour.

1. These may be represented then by BONA BETA CAN DINE.

The climates belonging to the second hour commence at  $30\frac{3}{4}$  deg. Widths of the three following climates are,  $5\frac{3}{4}$  deg., 5 deg., 4 deg.

2. Represented by MUSAM LAMA L' AIR.

The climates belonging to the third hour begin at 49 deg. Widths of the three following climates are, 3 deg.,  $2\frac{1}{2}$  deg.,  $2\frac{1}{4}$  deg.

3. Represented by EUROPE, GO NUN NOTE.

The climates belonging to the fourth hour begin at  $53\frac{1}{2}$  deg. Widths of the three following climates are,  $1\frac{1}{2}$  deg.,  $1\frac{1}{4}$  deg.,  $1\frac{1}{4}$  deg.

4. Represented by LUBIN, TUNE QUITE QUIET.

The climates belonging to the fifth hour begin at  $62\frac{3}{4}$  deg. Widths of the three following climates are,  $\frac{3}{4}$  deg.,  $\frac{1}{2}$  deg.,  $\frac{1}{2}$  deg.

5. Represented by DAMON, GO, O NO, NO.

The climates of the sixth hour commence at  $65\frac{1}{4}$  deg. Widths of the three following climates are,  $\frac{1}{4}$  deg.,  $\frac{1}{4}$  deg.,  $\frac{1}{4}$  deg.

6. Represented by the Chinese at the DELUGE SAT AT TEA.

*Ex.* In what climate\* is Madrid situated? The latitude of Madrid is 41 deg. N.

41 deg. is contained in the second sentence which begins with  $30\frac{3}{4}$  deg., the commencement of the fourth climate; then the two following climates are LAMA L',  $5\frac{3}{4}$  deg. +  $5 = 10\frac{3}{4}$  and  $30\frac{3}{4} + 10\frac{3}{4} = 41\frac{1}{2}$  deg.; the beginning of the 6th climate, consequently 41 deg. N. lat., is situated in the 5th climate.

A person travelled due west from Gibraltar until his time varied 4 hrs. 40 min., and then altered his course to due north for 240 miles; required the latitude and place, in what climate it is situated, and the bearing of the place from Gibraltar.

In what climates are the following places: London, Copenhagen, Petersburg, Lima, Jamaica, Rome, Lisbon, Pekin, Calcutta, and Constantinople?

### PROBLEM XVIII.

*To find the Breadth of any Climate.*

**RULE.** Find, according to the table, how many degrees make a difference of 15 minutes in the given climate.

*Ex.* What is the breadth of the 5th climate, and what capitals are situated within it?

According to the 2d sentence, the 4th climate begins with

\* All places situated in the same latitude are in the same climate, but they have not the same temperature on account of local circumstances; for instance, the Andes are situated in the torrid zone, the summits of which are perpetually covered with snow, which cools the air in the adjacent country and renders the climate temperate.

$30\frac{3}{4}$  deg., the width of this climate LAMA  $5\frac{1}{4}$  deg., making  $36\frac{1}{2}$  deg. the beginning of the 5th climate : the breadth of the 5th climate L' 5 deg. ; and the capital cities contained between  $30\frac{1}{4}$  and  $36\frac{1}{2}$  deg. are, Lisbon, Madrid, Naples, Athens, Constantinople, Samarkand, Ladack, Pekin, Washington, Buenos Ayres, and St. Jago.

What are the breadths of the following climates, 4th, 7th, 9th, 11th, 12th, 13th, 19th, and 24th ?

A person travelled 840 m. South from the capital of a country of Europe, which stands upon an island belonging to the country ; required what place he arrived at, in what climate situated, and what bearing it has from Vienna.

August 30th, in the year 70 A. D., was destroyed one of the most renowned cities of the world ; and when the sun is upon its meridian on May 21, he is vertical to a place 705 miles south ; required the name of the city, its latitude, and in what climate it is situated.

### PROBLEM XIX.

*To find the Time of the Sun's setting and the Length of the Longest Day and Night in the Temperate Zones.\**

**RULE.** Find by the Table of Climates the ascensional difference or time after six o'clock that the sun sets corresponding to the given latitude ; double the time of the sun's setting for the length of the longest day in summer and the longest night in winter. From 24 hours take the

\* To find the time of the sun's setting and rising for England, see table-page.

length of the longest day, and the remainder will be the length of the shortest night.

*Ex.* Find the length of the longest day and shortest night at St. Petersburg, and at what hour the sun sets, in summer, on the longest day, and in winter, on the shortest day, at that place.

The lat. of St. Petersburg is 60 deg. N.

60 deg. of lat. belongs to the 13th climate.

$13 \times 15$  minutes, the ascensional difference, equals 3 hours 15 minutes, the time after 6 o'clock that the sun sets.

hrs. min.          hrs. min.

Then  $9 \dots 15 \times 2 = 18 \dots 30$ , length of the longest day.

hrs. hrs. min.

$24 - 18 \dots 30 = 5 \dots 30$ , length of the shortest night.

The time of the sun's setting in summer, taken from 12 hours, gives the time of setting, on the opposite day, in

hrs. hrs. hrs.

winter. Therefore  $12 - 9\frac{1}{2} = 2\frac{1}{2}$ , the time of the sun's setting in winter on the shortest night.

What is the length of the longest day and shortest night at the following places: Copenhagen, Philadelphia, Quebec, Rome, London, Vienna, Cairo, and Madrid?

May 20, 1506, Columbus died at Valladolid, 42 deg. N., what was the length of its longest day and shortest night; the declination of the sun on the above-named day; and his meridian altitude?

Suppose a person to travel south from Archangel 64 deg. N. on its longest day, and were to travel for 12 such days at the rate of 9 miles per hour, in what latitude would he then be, and what would be the difference of the longest days in the two latitudes?



## A TABLE

*Of the Number of Geographical Miles in a Degree of Longitude in the Complement of every Latitude.*

Degrees Compl. of Lat., or Deg. of Asc. diff.	Geographical Miles, or Degrees of Declination.	Degrees Compl. of Lat., or Deg. of Asc. diff.	Geographical Miles, or Degrees of Declination.	Degrees Compl. of Lat., or Deg. of Asc. diff.	Geographical Miles, or Degrees of Declination.
1	1,05	31	30,90	61	52,48
2	2,09	32	31,79	62	52,97
3	3,14	33	32,68	63	53,46
4	4,18	34	33,53	64	53,93
5	5,22	35	34,41	65	54,38
6	6,27	36	35,27	66	54,81
7	7,31	37	36,11	67	55,23
8	8,35	38	36,94	68	55,63
9	9,38	39	37,76	69	56,01
10	10,42	40	38,57	70	56,38
11	11,45	41	39,36	71	56,73
12	12,48	42	40,15	72	57,06
13	13,50	43	40,92	73	57,38
14	14,52	44	41,68	74	57,67
15	15,53	45	42,43	75	57,95
16	16,54	46	43,16	76	58,22
17	17,54	47	43,88	77	58,46
18	18,54	48	44,59	78	58,69
19	19,53	49	45,28	79	58,89
20	20,52	50	45,96	80	59,09
21	21,50	51	46,63	81	59,26
22	22,48	52	47,28	82	59,42
23	23,45	53	47,92	83	59,55
24	24,40	54	48,55	84	59,67
25	25,36	55	49,15	85	59,77
26	26,30	56	49,74	86	59,85
27	27,24	57	50,32	87	59,92
28	28,17	58	50,88	88	59,96
29	29,09	59	51,43	89	59,99
30	30,03	60	51,96	90	60,00

## PROBLEM XX.

*The Length of the Day being given at any Place in the Temperate Zones, to find the Sun's Declination and the Day of the Month.*

**RULE.** Find the length of the longest day by the table of climates, then say as the ascensional difference of the longest day is to the ascensional difference of the given day, so is the greatest declination to the declination required; then the day which corresponds to this declination is the day required.

*Ex.* What are the sun's declination and the day of the month at Gibraltar, when the day is 14 hours long?

The length of the longest day at Gibraltar is 15 hours.

15 hrs. — 12 =  $\frac{3}{4}$  hrs. =  $1\frac{3}{4}$  hrs., the ascensional difference of the longest day. 14 hrs. — 12 hrs. =  $\frac{2}{4}$  = 1 hr., ascensional difference on the given day.

hrs. hr. deg. deg.

Then as  $1\frac{3}{4} : 1 :: 23\frac{1}{2} : 15\frac{1}{2}$ .

$15\frac{1}{2}$  deg. the sun's declination on the required day.

The days answering to this declination are May 3 and August 11.

What are the declination and the day of the month at the following places: Boston, when the day is 13 hours long? Rome, when the day is 11 hours long? Petersburg, when the day is 17 hours long? And at Lisbon, when the day is 12 hours long?

**SENTENCES** *by which the number of Miles in a Degree of Longitude in the Complement of every Latitude may be found.*

1. *Aries*, in the heavens, finds it EASY TO SOAR.  
EASY O the sign commences with.



To SOAR, 10,4 miles increased in 10 deg. of latitude.

2. *Taurus*, in the heavens, To SOAR, from the earth was TOST.

10 deg. the sign commences with, the complement of latitude 80 deg.

To SOAR, 10,4 miles in a degree of longitude, in latitude 80 deg.

TOST 10,1 miles, increased in the next 10 deg. of latitude.

3. *Gemini* HAS JOY when encircling the POLE.

20 deg. the sign commences with, the complement of latitude 70 deg.

HAS JOY 20,5 miles in a degree of longitude, in latitude 70 deg.

POLE, 9,5 miles increased in 10 deg. of latitude.

4. *Cancer*, was sent to bite Hercules, now GOES ABOVE.

30 deg. the sign commences with, the complement of latitude 60 deg.

GOES 30 miles in a degree of longitude, in latitude 60 deg.

ABOVE 86 miles increased in 10 deg. of latitude.

5. *Leo* rested on MOWED hay in a cave placed with CARE.

40 deg. the sign commences with, the complement of latitude 50 deg.

MOWED, 38,6 miles in a degree of longitude, in latitude 50 deg.

CARE, 7,4 miles increased in 10 deg. of latitude.

6. *Virgo* on harvests can READ an ODE.

50 deg. the sign commences with, the complement of latitude 40 deg.

READ, 46 miles in a degree of longitude, in latitude 40 deg.

ODE, 6 miles increased in 10 deg. of latitude.

7. *Libra* crosses the LINE Southward to meet AURORA.  
60 deg. the sign commences with, the complement of  
latitude 30 deg.

LINE, 52 miles in a degree of longitude, in latitude 30  
deg.

AURORA, 4,4 miles increased in 10 deg. of latitude.

8. *Scorpio* killed a LEADER, whose club was AN OAK.  
70 deg. the sign commences with, the complement of  
latitude 20 deg.

LEADER, 56,4 miles in a degree of longitude, in latitude  
20 deg.

AN OAK, 2,7 miles increased in 10 deg. of latitude.

9. *Sagittarius*, in after LIFE, in heaven was SET.

80 deg. the sign commences with, the complement of  
latitude 10 deg.

LIFE, 59 miles in a degree of longitude, in latitude 10  
deg.

SET, one mile increased in 10 deg. of latitude.

*Explanation to the preceding Sentences.*

In the above sentences, 10 deg. of latitude are given  
with each sign of the Zodiac, commencing at the Pole;  
and the miles in a degree of longitude, in the latitude the  
sign commences with; together with the miles increased  
in a degree of longitude, in the next 10 deg. of latitude.  
The first sign commences with 0 deg.; the second with  
10 deg., the complement of 80 deg. latitude; the third  
sign with 20 deg., the complement of 70 deg. latitude, &c.  
And because the miles in a degree of longitude, for the  
latitude each sign begins with, and the miles increased in a  
degree of longitude, in the next 10 deg. of latitude are  
given in degrees and decimal parts of a degree, there will

be no difficulty in finding the number of miles in a degree of longitude in any other latitude connected with the sign ; for, by removing the decimal point one\* place to the left, in the miles increased in each 10 deg. of latitude, the proportional increase of miles in a degree of longitude will be given for each degree of latitude. Thus, if required to find the miles in a degree of longitude, in latitude 55 deg., the complement of the latitude, viz. 35, will give the number of miles in a degree of longitude, for the latitude 55 deg., in the sentence, and 30 deg. are given with the fourth sign, beginning with 30 deg. GOES ; the number of miles in a degree of longitude is 30 ; and the miles increased in the next 10 deg. of latitude are ABOVE 8,6 ; and by removing the decimal point one place to the left, ,86 will be the proportional increase of miles in a degree of longitude, of each degree of latitude given in the sign ; consequently  $,86 \times 5 = 4,30$  the miles increased in a degree of longitude, in the 5 deg. of latitude ; therefore,  $30 + 4,3 = 34,3$  miles in a degree of longitude, in latitude 55 deg.

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#### PROBLEM XXI.

*To find the number of Miles in a Degree of Longitude in any Latitude.*

**RULE.** Take the complement of the latitude, and find in which of the sentences it is given ; then, if the complement of the latitude be the same as the first degree given in the sentence, the miles required are given ; but, if more,

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\* By removing the point one place to the left is dividing by 10]

multiply the decimal of the miles increased in a degree of longitude, by the number of degrees the complement of the given latitude is more than the first degree given in the sentence; this product add to the miles given in the sentence for the first degree, and the sum will be the miles required in a degree of longitude in the given latitude.

*Ex. 1.* Find how many miles are in a degree of longitude in latitude 48 deg.

90—48 deg.=42 deg. comp. of latitude is given in fifth sentence.

	Deg.	Miles.
Fifth sentence begins with	40	= 38.6.
Miles.		

7.4 increase in 10 deg. the  
increase in one deg. is, 74 and,  $74 \times 2 = 1.68$ .

	deg.
40.08 mil. in par.	48

*Ex. 2.* Find the number of miles in a degree of longitude in the latitude of Constantinople or 41 deg. North.

90 deg.—41 deg. = 49 deg. comp. latitude is given in fifth sentence.

	Deg.	Miles.
Fifth sentence begins with	40	= 38.6.
Miles.		

7.4 increase in 10 deg. and  
in one deg., 74 and.....,  $74 \times 8 = 5.92$ .

	deg.
44.52 mil. in par.	49.

*Ex. 3.* How many miles do the inhabitants of Jerusalem go by the earth's motion in 24 hours?

*Ex. 4.* Find the number of miles per day and per hour that the natives of Petersburg travel by the earth's rotation.



*Ex. 5.* Find the rate per hour at which the convicts at Port Jackson are carried by the earth's rotatory motion, latitude 34 deg. South, and say whether the natives of Bagdad go faster or slower than those of Port Jackson.

### PROBLEM XXII.

*To find at what Rate per Hour the Inhabitants of any given Place are carried, from West to East, by the Revolution of the Earth upon its Axis.*

**RULE.** Find how many miles make a degree of longitude in the latitude of the given place, which multiply by 15, and the product will be the answer.

*Ex.* At what rate per hour are the inhabitants of Madrid carried from West to East by the revolution of the earth upon its axis?

The latitude of Madrid is 41 deg.

In latitude 41 deg., a degree of longitude measures 52 English miles; then  $52 \times 15 = 780$  miles an hour.

At what rate per hour are the inhabitants of Petersburg carried by the earth's diurnal motion; of Calcutta, Cape Horn, Lima, Jamaica, Amsterdam, and North Cape?

Suppose a person to travel from Petersburg due South for 5400, at what place would he arrive, and at what rate per hour would he be carried at the two places?

If a person were to travel from Copenhagen East, and to start at noon, how many miles must he travel per hour to keep pace with the sun, or to have noon with him constantly?

## PROBLEM XXIII.

*To find at what Time the Sun rises and sets at any place in the Temperate Zones.*

**RULE.** Find the sun's declination on the given day, and find by the Table of Climates the length of the longest day in that latitude : then say, as the sun's greatest declination is to his declination on the given day, so is the ascensional difference of the longest day, to the ascensional difference on the given day.

**Ex.** At what time will the sun rise and set at London on the first of June ?

The sun's declination on June 1 is 22 deg. N.

Deg. Deg. Ho. Ho. Min.

Then  $23\frac{1}{2}$  : 22 : :  $2\frac{1}{4}$  : 2 : 6.

$2\frac{1}{4}$

44

5.5

— Hours.

23.5) 49.5 (2, 1.

47 0 60.

250

235

.15

Hours Min.

2 : 6 Ascensional difference.

6 : —

8 : 6 Time of the sun's setting.

3 : 54 Time of the sun's rising.

7 : 48 Length of night.

16 : 12 Length of day.



At what time does the sun rise and set at Malta, 36 deg. N., August 4; Vienna, 48 deg. N., April 7; Boston, 42 deg. N., June 1; Petersburg, 60 deg. N., September 4; Quebec, 47 deg. N., February 3; Messina, 38 deg. N., May 20; Lima, 12 deg. S., July 27; and at Lisbon, 39 deg. N., June 21?

May 1st, a person started from Rome three hours before sunrise to travel Northward for 40 days at the rate of 40 miles a day; required at what time he commenced his journey, what latitude he would reach, and what was the sun's meridian altitude at Rome on May 1.

September 29, 1758, gave birth to the illustrious Nelson; required the length of that day at London, and in what latitude a person must be to have the sun in his zenith on that day.

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#### PROBLEM XXIV.

*To find the Beginning, End, and Duration of Twilight in the Temperate Zones.*

**RULE.** Find the sun's declination and the corresponding ascensional difference for that declination, to which add one hour; and if the latitude be under 30 deg., add one degree or four minutes; if above 30 deg., and under 45 deg., add 2 deg. or 8 minutes; if above 45 deg., add 3 deg. or 12 minutes, for the length of twilight.

**Ex.** Required the beginning, end, and duration of twilight at London on April 19.

	Ho.	Min.
Sun's declination $11\frac{1}{4}$ deg., and ascensional difference is .....	1	1
To which add for 18 deg. ....	1	—
Latitude $51\frac{1}{2}$ deg. gives 3 deg., or.....	12	
	<hr/>	
Duration of twilight.....	2	13

What is the duration of twilight at Rome, August 6; Sierra Leone, April 30; Jamaica, June 21; Stockholm, June 21 and April 1?

Required how many miles a place must be South from London to have the sun 18 deg. below its horizon at midnight.

At that place where the clocks are 7 hours 44 minutes earlier than at London, and 2400 miles distant from the Equator, required the duration of twilight May 1.

### PROBLEM XXV.

*To find to what Places it is Noon, and where the Sun is rising and setting, at any given Hour.*

RURE 1. If the time be after noon at London, turn as many degrees Westward as are equal to the time, and this will give the meridian to all places where it is then noon: the same degree on the opposite quadrant is midnight: 90 degrees on the left of the sun is that part of the Equator where the sun is rising, and 90 degrees to the right is that part where it is setting: and for all intermediate places between the equator and the Poles, take a proportional

part according as the declination is more or less than  $23\frac{1}{2}$  deg.

**RULE 2.** If the time be before noon at London, then turn East as many degrees as are equal to the time before noon, and it will give the meridian to all places where it is then noon; and proceed with the rising and setting, as in Rule 1.

**Ex.** When it is 54 minutes past 4 o'clock in the morning at London, on the 5th of March, to what place is it noon, and where is the sun rising and setting?

4 hours 54 minutes in the morning = 7 hours 6 minutes before noon, and 7 hours 6 minutes =  $105 + 1\frac{1}{2} = 106\frac{1}{2}$  deg. E. of London, or  $16\frac{1}{2}$  deg. upon the second quadrant of East longitude. The places of  $16\frac{1}{2}$  deg. are Java, Borneo, Cochin China, China, and Lake Baikal.

The places to which the sun is rising are the Cape of Good Hope, Congo, Bornou, Barca, Candia, Turkey, St. Petersburg, and the White Sea.

The places to which the sun is setting are Bhering's Straits, and the islands between the Friendly and Society Islands.

When it is 8 A. M. at London, where is it then noon, midnight, 6 A. M., and 6 P. M.?

June 29, at 7 P. M. at London, where is the sun rising, where setting, to what place is it vertical, and where is it then midnight?

December 4, at 7 P. M. at St. Petersburg, where was the sun then rising, setting, where noon, midnight, and where 4 o'clock A. M.?

At the following hours at London, on March 21, where is it then noon, and where is the sun rising and where setting; 4 P. M., 12 P. M., 9 A. M., 11 A. M., 10 P. M., 3 A. M., and 6 P. M.?

A ship bound to India was, on a certain day, upon the same meridian as London, and 1200 miles South of the Equator: required her latitude and the day of month.

### PROBLEM XXVI.

*To find the Sun's rising and setting Amplitude at any Place, or the Distance it rises from the East and sets from the West.*

**RULE.** Square the sun's declination and the ascensional difference—the square root of the sum will be the amplitude.

**Ex.** What is the sun's amplitude at London on the 21st of June?

The sun's ascensional difference is  $2\frac{1}{4}$  hrs. =  $33\frac{1}{4}$  deg.

$$23\cdot5 \times 23\cdot5 = 552\cdot25$$

$$33\cdot75 \times 33\cdot75 = 1139\cdot06$$

---

1691·31 the square root of which = 40 deg. amplitude.

What is the sun's amplitude at Gibraltar, August 4, at Calcutta, Dec. 7, and Petersburg, July 2?

June 18, 1815, the Battle of Waterloo was fought, in which the physical nerve and courage of Britons performed prodigies not excelled by ancient heroes; what was the sun's rising and setting amplitude on this day which witnessed the total eclipse of Bonaparte's power?

Oct. 13, 1815, Bonaparte arrived at St. Helena, where he died on May 5, 1821; how many degrees to the East or West points did the sun rise and set on those days?



## PROBLEM XXVII.

*To find the Latitude of a Place by knowing the Sun's Altitude at a given Hour and Day.*

**RULE.** Square the Zenith distance at the given time, and square the number of degrees corresponding to the time before or after noon, and the square root of their difference will be the zenith distance at noon—to which add the sun's declination for the given day for the latitude.

**Ex.** Suppose on the 19th of June, in North latitude, the sun's altitude to be 65 deg. 24 min. at 10 hours 29 min. A. M. ; required the latitude.

The sun's declination on June 19, is  $23\frac{1}{2}$  deg.

Deg. Deg.  
 $90 - 23\frac{1}{2} = 66\frac{1}{2}$  complement of the sun's declination.

$90 - 65\frac{1}{2} = 24\frac{1}{2}$  zenith distance.

$10\frac{1}{2}$  hours or  $1\frac{1}{2}$  hour's time before noon  $= 22\frac{1}{2}$  deg.

The number of miles\* corresponding (in Table, p. 173) to the complement of the sun's declination is  $55\frac{1}{4}$  miles.

Then  $55 \cdot 25$

$22\frac{1}{2}$

---

11050

11050

2762

---

60) 1243·12

20·718 number of deg. answering to  $11\frac{1}{2}$  hours.

\* As the number of miles in a degree of longitude varies in every parallel of latitude, to make a degree of longitude equal to a degree of latitude, it is necessary that each side of the triangle

$$24 \cdot \frac{2}{3} = 600 \cdot 25$$

$$20 \cdot 71 \frac{1}{2} = 429 \cdot 235524$$

---


$$\sqrt{171 \cdot 02} = 13 \quad \text{zenith distance at noon.}$$

$$23 \frac{1}{4} \quad \text{sun's declination.}$$

---


$$36 \frac{1}{4} \quad \text{latitude required.}$$

On May 21st, the sun's altitude was observed to be 54 deg. at 9 A. M.; required in what latitude.

April 12th, at 10 A. M., the sun's altitude was found to be 43 deg.; required in what latitude this was.

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### PROBLEM XXVIII.

*To find the Distance between any two Places.*

**RULE.** If the two places be situated upon the same parallel of latitude, find their difference of longitude, and then find how many miles make a degree in that parallel of latitude, by which multiply the difference of longitude: but if they have not the same latitude, find a mean latitude,\* then the number of miles in a degree of longitude in this mean latitude, multiplied by the difference of longitude, and the product divided by 60 for the distance in degrees of the Equator, which, with the difference of latitude, form two sides of a right-angled triangle; then square both sides, and the square root of the sum of the squares will be the hypotenuse or distance required.

be similar. Take the complement of latitude, and find in the Table, p. 173, how many miles make a degree in that complement, which multiply by the degrees of difference of longitude, and the product divide by 60—the quotient will be the number of degrees of longitude of 60 miles each, like the degrees of latitude.

\* To find a mean latitude, take the difference between the two parallels; to half this difference add the lesser latitude for the mean latitude,



Ex. Required the distance between London and Bagdad. (See Plate 1, Fig. 2.)

As the two places are situated upon different parallels, a mean parallel must first be found, which, with the difference of latitude, forms a parallelogram or square, the diagonal of which is the distance of the two places.

Deg.	
51 $\frac{1}{2}$	90
33	42 $\frac{1}{4}$ mean lat.
<hr/>	
2) 18 $\frac{1}{2}$ diff. of lat. A. G.	47 $\frac{3}{4}$ comp. of mean lat.
9 $\frac{1}{4}$	
33	
<hr/>	
42 $\frac{1}{4}$ mean lat. C. D.	

The number of miles in a degree answering to 47 $\frac{3}{4}$ , according to Table, p. 173, is 44 $\frac{1}{2}$  miles to a degree.

The difference of longitude between London and Bagdad is 45 deg., then 44 $\frac{1}{2}$  deg.  $\times$  45 = 2002 $\frac{1}{2}$   $\div$  60 = 33 $\frac{1}{3}$  deg. nearly; i. e. 45 deg. of long. in lat. 44 $\frac{1}{2}$  deg. equal only 33 $\frac{1}{3}$  deg. at the Equator. Then square the difference of lat. and the mean long. and the square root of their sum will be the distance required.

$$\text{Diff. of Lat. } 18\frac{1}{2} \times 18\frac{1}{2} = 342$$

$$\text{Mean Long. } 33\frac{1}{3} \times 33\frac{1}{3} = 1102$$

1444	( 38 deg.
9	60
<hr/>	
68	544 2280 miles from London to
	544 Bagdad.
<hr/>	
...	

Find the distance between Constantinople and Petersburg, Amsterdam and Calcutta, Tornea and Madrid, Warsaw and Paris.

Required the distance between Lisbon and Mecca, between Calcutta and Pekin, and between Abo and Medina.

A ship left the port of Lisbon and sailed S. W., until her longitude was 45 deg. W. and her lat. 10 deg. N. ; required the length of her course in miles.

*To find the Antæci, Periæci, and Antipodes, to the Inhabitants of any Place, and the Difference of Time.*

After the pupil has acquired a knowledge of the longitude and latitude of places, it will be well, in order to give him a correct idea of the relative situation of cities, that he give them locality upon the quadrants or walls of his room, and suppose that each quadrant is divided by meridians into divisions corresponding to six hours, the time the sun is in passing over one quadrant, making upon the four quadrants 24 hours, the length of the day or time that the sun takes to make an apparent revolution round the earth. A room thus becomes a globe, and the four walls or quadrants will contain the various countries of the world, and the divisions of the quadrants will represent the colures. The Equator must be supposed an imaginary line in the middle passing round the room, and, on that part of the ceiling and floor where the colures would intersect each other, will shew the poles : the tropics, arctic and antarctic circles, will be placed according to their distance from the equinoctial, and on the quadrants according as the floor or the middle of the wall may represent the Equator. Then, if we suppose London, which is upon the first meridian, placed in one corner, or upon the colure, we shall have on

the left or West of it Ireland, Scotland, part of Africa, Spain, and Portugal, Iceland, Greenland, N. and S. America, and the islands of the Pacific Ocean, as far as New Zealand: on the right or East of London, we have the kingdoms of continental Europe, not before named, Asia and its islands, the greatest part of Africa, and Australasia.

The locality of countries being once ascertained, we instantly discover the relative situation of places: thus, to find the antipodes of Spain is only to pass over to the same degree of longitude as Spain, to the opposite quadrant, where we find New Zealand; or to find the antœci of the inhabitants of Malay, we pass as many degrees on the opposite side of the Equator, which corresponds with Sumatra, or to find the periœci of Lisbon, we cross the Atlantic to Washington. Whatever time it is at London, it is always after that time to all places East of London, as much in time as is equal the difference of longitude between the two places: and to all places West of London, it is before the time at London as much as is equal to their difference of longitude. See Plate 1.

#### MISCELLANEOUS QUESTIONS.

1. WHAT day has the same length as the 24th of March?
2. If the sun's meridian altitude be 40 deg., what is the day of the month, and what month is it?
3. On what day of the month is the sun's meridian altitude at Madrid equal to the latitude of that place?
4. How much should the clocks at Copenhagen be faster than those of Dublin?
5. How many degrees does the sun shine beyond the Pole on May 21st?



6. How many geographical miles must a person travel from London southward that the meridian altitude of the North Polar Star may be diminished 25 deg.?

7. What place on the globe has the least longitude, the greatest longitude, no longitude, and every longitude?

8. If a pole of 24 feet long be placed perpendicularly to the horizon of London on July 12th, and another of the same length be so placed at Moscow, which will cast the longer shadow at noon?

9. If one man were to travel 3 miles per hour westward round the earth at the Equator, and another 2 miles per hour westward in latitude 60 deg. north, in how many would each return to the place whence he set out?

10. How many days, at the rate of 8 miles per day, must a person travel to go round the globe in the latitude of Moscow, and at what height at noon, above the horizon, will the sun appear to him?

11. Will the shadow of the persons at Calcutta be East or West on June 6th, when it is 5 in the morning at London; and will they be North or South when it is noon there?

12. What is the difference in the rate per hour at which the inhabitants of Tornea and Constantinople are carried by the earth's rotatory motion?

13. What is the distance, as the bird flies, between Lisbon and London; and whether should the clocks be more or less than 36 minutes faster or slower than those of London?

14. The sun was seen  $41\frac{1}{2}$  deg. above the horizon on April the 20th at noon; to what places would he be seen this height?

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## P R O B L E M S

RELATING TO THE CELESTIAL GLOBE, TO BE  
SOLVED MENTALLY.

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*On the Circles relating to the Sphere.*

To ascertain the positions of the celestial bodies, the times of their rising, culminating, and setting, &c., we suppose the globe of the earth to be surrounded by several imaginary circles, called circles of the sphere,\* which are either fixed or moveable, the former having always the same position in the heavens, but the latter varying according to the position of the observer.

The Equinoctial, the Ecliptic, with their parallels, and the meridians, are the fixed circles; these have their rise from the two-fold motion of the earth: the moveable circles are the horizon and its parallels or almucantars.

By a knowledge of these circles, the most interesting astronomical problems can be solved in the mind as easily as by a celestial globe: and by forming with these circles an imaginary celestial globe, the Equinoctial, Ecliptic, and meridians, &c., will be accurately and truly represented, and by the application of an imaginary hour line, the pupil can always possess a fund of rational amusement, as it

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\* See p. 6.

places before his view the positions of the heavenly host at any period of time, not to England only, but to any part of the earth.

*To form an imaginary Celestial Globe by two Rooms.*

Suppose the Celestial Globe to be represented by two rooms, one over the other. The southern hemisphere will be represented by the lower room, and the northern hemisphere by the upper room; the floor will represent the plane of the Equinoctial; the four Walls the four Quadrants, and the divisions between the walls the Solstitial and Equinoctial Colures which separate the four seasons and shew the commencement of each. The termination of the ceiling round the room will point out the Arctic circle in the upper room, and the limits of the floor in the lower room the Antarctic circle. Where the colures intersect each other on the ceiling in the upper room, and on the floor in the lower room, they will point out the Poles.

The signs of the Zodiac are placed at the bottom of each Quadrant according to their respective seasons. The parallels of declination are shewn by lines parallel to the floor, and the lines of right ascension by lines at right angles to the floor. These horizontal and perpendicular lines upon each of the Quadrants form four steps of declination, and four ladders\* of right ascension, and in these spaces the constellations are placed according to their right ascension and declination.

Round this Equinoctial is supposed to move an imagi-

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\* These ladders of right ascension and parallels of declination, with the constellations agreeing with them, must be fully impressed on the pupil's imagination, in order to form the ideal globe.



nary sun from Aries through the imaginary Zodiacal signs, agreeing with the sun's apparent course in the Ecliptic. An imaginary hour circle is supposed to accompany the sun, which shews the daily apparent time of a star's culminating or coming to the meridian.

*Remarks.*

1. The celestial globe is an artificial representation of the heavens; upon it are laid down the stars according to their relative and true situations. The diurnal motion of this globe is from East to West, and shews the apparent motions of the stars, &c.: when using this globe the student is supposed to be placed in its centre, and viewing the stars in the concave heavens.

2. This ideal celestial globe is represented by two rooms, upon the walls of which the stars are fixed in the imagination, in the same positions as they are seen in the heavens. The pupil is supposed to be placed in the centre of these two rooms, and viewing the stars upon the walls: and, when solving problems, in turning round Eastward, he represents the diurnal motion of the earth, and really shews the apparent motion of the sun, moon, and stars, from East to West. By the help of the imaginary hour circle, as he views any star in reference to this circle, he can immediately name the time of its culminating to any place.

*To remember the Zodiacal Signs.*

For the application of the two rooms observe that the walls should be numbered from the right hand towards the left.

The first wall to be called the spring quadrant, the next to the left the summer, the third the autumn, and the fourth the winter quadrant. The divisions of the walls, or the

corners of the room, will represent the colures; these point out the beginning of the seasons and the cardinal signs of the Zodiac, Aries, Cancer, Libra, and Capricornus: these will be placed at the bottom of the commencement of the four quadrants or walls; thus, Aries at the beginning of the first quadrant, Cancer at the beginning of the second quadrant, Libra at the beginning of the third quadrant, and Capricornus at the beginning of the fourth quadrant. The pupil will suppose an imaginary sun revolving in the Equinoctial, and occupying the same time which the sun takes in an apparent revolution in the Ecliptic—beginning at Aries, and passing over the first quadrant during spring, over the second during summer, and over the third and fourth quadrants during autumn and winter.

It is highly necessary that the student suppose he really sees each sign in its proper place before him, at the time he fixes them in his mind, according to their relative locality. These four signs and their places in the room being learnt perfectly, he will then place on the spring quadrant, at equal distances, the other two signs of Taurus and Gemini; on the summer quadrant Leo and Virgo; on the autumn quadrant Scorpio and Sagittarius; and on the winter quadrant Aquarius and Pisces. From the signs following, it will be seen that the sun enters each sign about the 20th of each month: and for the first quadrant, the unit figures of the sun's entering each sign are 1, 0, 1; on the second quadrant, 1, 3, 3; on the third quadrant, 3, 3, 2; and on the fourth quadrant, 2, 0, 9: these should be committed to memory very perfectly, as upon the knowledge of these and the sun's right ascension on entering each sign, much will depend upon the pupil's facility in giving solutions of the various problems

*The Zodiacal Signs of each Quadrant and their Characters.*

## First Quadrant, or Spring.

♈	Aries . . . .	sun enters 21 March.
♉	Taurus . . .	20 April.
♊	Gemini . .	21 May.

## Second Quadrant, or Summer.

♋	Cancer . .	sun enters 21 June.
♌	Leo . . . . .	23 July.
♍	Virgo . .	23 August.

## Third Quadrant, or Autumn.

♎	Libra . .	sun enters 23 Sep.
♏	Scorpio . .	23 Oct.
♐	Sagittarius	22 Nov.

## Fourth Quadrant, or Winter.

♑	Capricornus, sun enters	22 Dec.
♒	Aquarius . .	20 Jan.
♓	Pisces . . . .	19 Feb.

*Note.* Opposite signs and seasons will be seen by drawing lines through the centre of the floor from one Quadrant to the opposite one.

*To find the Sun's Right Ascension on entering each Sign of the Zodiac.*

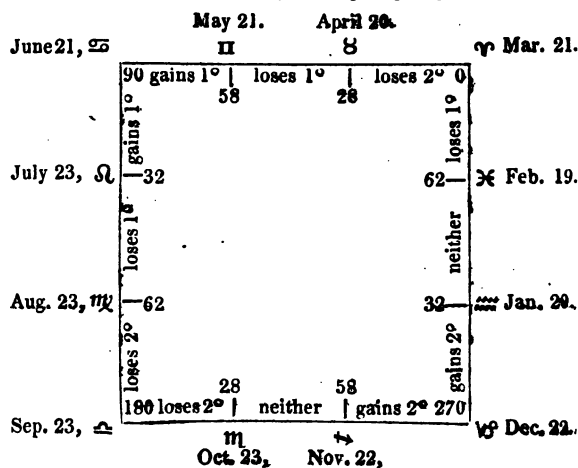
*Def.* The right ascension of a celestial body is an arch of the Equinoctial, contained between the point Aries and that point of the Equinoctial which is cut by the Meridian passing through the object. But in this system the right ascension is reckoned from each colure or the beginning of each quadrant.

2. All circles contain 360 degrees, a quadrant contains

90 degrees, each degree contains 60 minutes, and each minute 60 seconds, &c.

Since the Equinoctial contains 360 deg., and is cut by the colures into four quadrants of 90 deg. each; the four walls contain 360 deg., or 24 hours of time, and each quadrant 6 hours of time. Now, as the sun's right ascension is reckoned by the colures, in passing over them he can have no right ascension, nor upon entering each quadrant: but on entering the second and third signs in each quadrant he will have right ascension, having passed through one sign from each colure. The right ascension on entering the second and third signs in each quadrant will be seen by the annexed figure, with the loss or gain of right ascension in the whole sign, denoted in the sign by the words loss or gain.

*The following Figure shows how the Signs are to be placed in the Room according to the foregoing Rules.*



As the sun has no right ascension reckoned in passing the colures, and as the opposite signs will have the same right ascension from the colures, only four numbers, with the loss or gain of right ascension in each sign, are necessary to be remembered for finding the sun's right ascension for any given day of the year.

*Note.* When the sun's right ascension is given from the colure the true right ascension is known thus: Leo is 32 deg. from the colure on the second quadrant, therefore  $32 \text{ deg.} + 90 \text{ deg.} = 122 \text{ deg.}$ , the true right ascension.

*The Sun's Right Ascension on entering each Sign of the Zodiac by the Colures.*

First Quadrant, or Spring.	Second Quadrant, or Summer.
Aries .... 0 deg.	Cancer .. 0 deg.
Taurus .. 28	Leo..... 32
Gemini .. 58	Virgo.... 62
Third Quadrant, or Autumn.	Fourth Quadrant, or Winter.
Libra .... 0 deg.	Capricornus 0 deg.
Scorpio .. 28	Aquarius.. 32
Sagittarius 58	Pisces .... 62

When the right ascension of the sun or a star is found by the colures, 90 deg. must be added for each quadrant preceding the quadrant on which the star or sun is situated; but in finding the times at which stars culminate, this addition is never required, as every solution should take place upon the quadrant on which the star is situated.

From the sun's unequal motion in the Ecliptic, he passes over more than one degree of the Equinoctial daily in some signs and less than one degree daily in other signs, and this



inequality of the sun's apparent motion accounts for his completing the 360 deg. of the Equinoctial in 365 days, 5 hours, 48 min., 57 seconds.

*Observations.*

1. The Equinoctial points are Aries and Libra, where the Ecliptic intersects the Equinoctial. At the time the sun appears in either of these points, viz. on the 21st of March and the 23d of September, the day is equal to the night in every part of the earth.

2. The Solstitial points are Cancer and Capricorn. When the sun appears in either of these points, viz. in Cancer, on the 21st of June, it is the longest day to the inhabitants North of the Equator, and the shortest to the inhabitants South of the Equator. But when the sun enters Capricorn on the 22d of December, it is the shortest day to the inhabitants North of the Equator, and the longest to the inhabitants South of it.

3. The Ecliptic, or the sun's apparent path, cuts the Equinoctial in the points Libra and Aries, and touches the Tropics: hence one half of it will be above the floor, (the plane of the Equinoctial,) and the other half below it. The course of the sun's declination is limited by the tropic of Cancer North, and the tropic of Capricorn South, being each  $23\frac{1}{2}$  degrees from the Equinoctial. When the sun is above the floor, or during the time he passes over the first and second quadrants, the North Pole is enlightened, and when the sun appears in the signs below the floor the South pole is enlightened.

4. When it is winter with the inhabitants on the North side of the Equator it is summer to those on the South side of it. It is spring when the sun enters the third quadrant



to those people South of the Equator; summer when he enters the fourth; autumn when he enters the first; and winter when he enters the second quadrant; being exactly opposite to the inhabitants North of the Equator.

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## PROBLEM I.

*To find the Sun's right Ascension at apparent Noon on any given Day.*

Def. 1. Apparent noon is the time at which the sun comes to the South, or Meridian, or 12 o'clock, as shewn by a correct sundial.

2. Meridians, or lines of longitude, are semicircles, cutting the Equinoctial at right angles, and extending from the North to the South Pole.

During a revolution of the earth upon its axis, equal portions of the Ecliptic will not agree with equal portions of the Equinoctial or Equator, in consequence of the obliquity of the Ecliptic to the Equator; hence, time\* is always measured on the Equinoctial, and the difference of time between places on the earth is measured on the Equator. Hence to determine the sun's true right ascension for any day observe the following:

- RULE. 1. Find the sign the sun is in.  
2. When it entered the sign.  
3. How many degrees advanced in the sign.  
4. How many degrees on entering the sign,  
which must be added to the number for the right ascension

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\* To turn degrees into time and the contrary, see p. 143.

required, observing to make the deduction or addition for the loss \* or gain, as in the figure, p. 196.

Ex. 1. Required the right ascension of the sun on May 17th.

The sun is in Taurus; it entered on April 20; therefore from the 20th of April to the end of April are 10 days and 17 days in May will make  $10 + 17 = 27$  days advanced in Taurus, and on entering Taurus it was 28 deg.; hence  $28 \text{ deg.} + 27 \text{ deg.} = 55 \text{ deg.}$ , and, deducting *one* for the loss in the sign, will be 54, the sun's right ascension required.

Ex. 2. Find the sun's right ascension on June 12th.

The sun is in Gemini; it entered May 21st; to the end of May are 10 days, and 12 days in June make 22 days or degrees advanced in Gemini, and on entering Gemini it was 58 deg., then  $58 \text{ deg.} + 22 \text{ deg.} = 70 \text{ deg.}$ ; add one, for the gain, makes 71 deg., as required.

Ex. 3. Find the sun's right ascension on July 8th.

The sun is in Cancer; it entered on June 21st; to the end of June are 9 days, and 8 in July, make 17 days or degrees in Cancer; on entering Cancer it was 90 deg., then  $17 \text{ deg.} + 90 \text{ deg.} = 107 \text{ deg.}$ ; and adding 0 for the gain it will leave 107 deg. by the celestial globe, and 17 deg. from the colure.

Ex. 4. Required the sun's right ascension on November 2d.

The sun is in Scorpio, and it entered on October 23d; to the end of October are 8 days, and 2 days in November make 10 deg. advanced in Scorpio: on entering that sign it was 28 deg., hence  $28 \text{ deg.} + 10 \text{ deg.} = 38 \text{ deg.}$  right

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\* If the sun lose or gain 2 deg. in the whole sign, reckon one degree for more than 10 days, and 2 deg. for more than 25 days, and if only one day in the whole sign be lost or gained, add or subtract one after 20 days, and for less than 20 days reckon nothing.

ascension, from the third colure; and 38 deg. added to 180 make 218, true right ascension; being neither loss nor gain in that sign.

Ex. 5. Required the sun's right ascension on Mar. 5th.

The sun is in Pisces; it entered on the 19th February; from the 19th to the 25th are 6 days—then it has advanced in Pisces 6 deg.; on entering that sign it was 62 deg., making 68 deg. from the colure, and 68 deg. + 270 deg. = 338 deg. by the globe, and nothing to add or deduct, being less than 20 deg. in the sign.

Obs. The Sun enters

Aries, March 21, to the end of the month.....	10 days.
Taurus, April 20 .....	10
Gemini, May 21 .....	10
Cancer, June 21 .....	9
Leo, July 23 .....	8
Virgo, August 23 .....	8
Libra, September 23 .....	7
Scorpio, October 23 .....	8
Sagittarius, November 22.....	8
Capricornus, December 22.....	9
Aquarius, January 20 .....	11
Pisces, February 19 .....	9

If the pupil commit these to memory perfectly, he will have a ready method of finding the sun's longitude for any day, and the right ascension also.

Ex. Required the sun's longitude on May 15.

The sun is in Taurus; it entered April 20.

April 10 + 15 = 25 deg. in Taurus.

Required the sun's longitude, July 19th.

The sun is in Cancer.

Then for June 9 + 19 = 28 deg. in Cancer.

Find the sun's right ascension on the following days :

- |                   |                   |
|-------------------|-------------------|
| 1. March 21.      | 31. March 3.      |
| 2. June 21.       | 32. September 9.  |
| 3. September 23.  | 33. May 12.       |
| 4. December 22.   | 34. October 14.   |
| 5. March 20.      | 35. July 30.      |
| 6.        24.     | 36. February 3.   |
| 7.        29.     | 37. November 18.  |
| 8. April 2.       | 38. July 19.      |
| 9.        10.     | 39. June 27.      |
| 10. May 21.       | 40. February 1.   |
| 11. June 27.      | 41. March 13.     |
| 12. July 23.      | 42. June 9.       |
| 13. August 7.     | 43. July 1.       |
| 14. September 24. | 44. August 6.     |
| 15. March 17.     | 45. September 5.  |
| 16. April 8.      | 46. March 15.     |
| 17. December 4.   | 47. June 11.      |
| 18. July 9.       | 48. March 24.     |
| 19. August 16.    | 49. June 29.      |
| 20. June 15.      | 50. July 27.      |
| 21. July 7.       | 51. August 31.    |
| 22. December 9.   | 52. June 30.      |
| 23. August 12.    | 53. May 31.       |
| 24. May 14.       | 54. September 29. |
| 25. June 20.      | 55. November 21.  |
| 26. July 16.      | 56. December 30.  |
| 27. September 15. | 57. February 19.  |
| 28. April 14.     | 58. May 16.       |
| 29. June 7.       | 59. March 31.     |
| 30. August 8.     | 60. July 3.       |



What is the sun's right ascension when the days and nights are equal ?

What is the sun's right ascension on the longest and shortest days ?

## PROBLEM II.

*To find when the Sun will have a given Right Ascension.*

1. If the sun have less than 90 deg. of right ascension, he is upon the first quadrant ; if less than 180 deg., and more than 90 deg. upon the second quadrant ; if less than 270 deg., and more than 180 deg. upon the third quadrant ; if less than 360 deg., and more than 270 deg. upon the fourth quadrant.

RULE. Find the quadrant the sun is upon, the sign \* he is in, and how many degrees advanced in the sign : and the day of the month agreeing with this degree of the Ecliptic will be the day required, regarding the allowance for the loss † or gain, as in the last Problem.

\* If the sun's right ascension upon the first and third quadrants be less than 28 deg., it is in the first sign ; if less than 58 deg. and more than 28 deg. in the second ; and if less than 90 deg. and more than 58 deg. in the third sign. Also upon the second and fourth quadrants, if less than 32 deg. it is in the first sign ; if more than 32 deg. and less than 62 deg. in the second ; and if more than 62 deg. and less than 90 deg. in the third sign.

† An allowance must be made for the loss or gain in the days in the same manner as for the loss or gain of right ascension, only observe that when the degrees are added for the right ascension, the days must be subtracted for the day of the month,

1. On what day of the year will the sun have 74 deg. of right ascension ?

The sun is on the first quadrant, and being more than 58 deg. is in Gemini; then  $74 \text{ deg.} - 58 \text{ deg.} = 16 \text{ deg.}$ , or 16 days after the 21st May, and  $21 + 16 = 37 - 31 = 6$  days in June.

2. On what day of the month will the sun have 277 degrees of right ascension ?

The sun is on the fourth quadrant; then  $277 \text{ deg.} - 270 \text{ deg.} = 7 \text{ deg.}$ , and in the first sign being less than 32 deg., then it was 7 days after December 22, and  $22 + 7 = 29$  December; there is no loss or gain to account for, being only 7 deg. in the sign.

3. On what day of the month will the sun have 175 degrees of right ascension ?

Ent.

On 2d Quad.

in  $\text{Aug. } 23.$

$175 \text{ deg.} - 90 \text{ deg.} = 85 \text{ deg.} - 62 \text{ deg.} = 23 + 23 = 46 - 31 = 15$  days in September, and being 23 deg. in Virgo, 2 days must be added, making the 17th of September.

On what days of the year will the sun have right ascension as following :

317	163	284	36	175	219
234	147	176	178	219	174
90	321	312	216	213	73
173	162	167	173	316	149
214	189	217	324	172	127

and where the degrees are subtracted, the days must be added. It will be seen by the globe that only 28 deg. of the Equinoctial from Aries correspond to 30 deg. of the Ecliptic, hence two days or degrees must be added to make the same number of degrees, thus making a loss of 2 deg. to the Equinoctial.



*To point out the Positions of the chief Stars as seen in  
the Heavens.*

The four seasons have before been represented by the four walls of the room, let these now represent the four quadrants of the Northern and Southern hemispheres. The quadrants consist of numerous stars which astronomers have divided into groups, called constellations, to which both the ancients and moderns have given the names of things, of useful inventions, and of various animals. To facilitate the learning of the positions of these clusters of stars, each quadrant is supposed to be divided into four ladders, and each ladder into four steps, making the width of each ladder  $22\frac{1}{2}$  deg. of right ascension, and each step  $22\frac{1}{2}$  deg. of declination, so that the end of the first ladder is  $22\frac{1}{2}$  deg. ; of the second 45 deg. ; of the third  $67\frac{1}{2}$  deg. ; and the end of the fourth 90 deg. ; and the same divisions are used for the steps.

In the steps and between the ladders the names of the constellations and the chief stars are correctly laid down, to the third magnitude—beyond which few treatises on the globes make mention in the solution of problems. The boundary of each constellation is indicated, so that it may be seen whether a constellation be upon one or more ladders.

At the time the pupil impresses his memory with the locality of the stars, the map and globe should be before him : he then supposes the first wall his extended blank map, which he must proportionally divide, agreeing with the map, Plate III., placed before him, into ladders and steps. Then beginning with the first step of the first ladder of the wall, he transfers to it the constellation and star, in the first step on the map, which is the Fish ; then on the second step, Andromeda, and on the third Cassiopeia. In

the same way he will begin the first step on the second ladder, and put the Whale and Ram ; on the second, the Triangles and the Fly ; on the third, Gamma in Perseus, and on the fourth step the Reindeer, and so proceed with all the other steps, fully learning one quadrant before proceeding to another, till they are all impressed on the imagination.

Of the two technical words denoting a star's declination and right ascension, the upper one always denotes the right ascension, and the lower the declination.

Remark. 1. The right ascension of the stars is reckoned from the beginning of each colure or season.

2. The steps and ladders being parallels of declination, and celestial meridians measure the star's right ascension and declination.

3. No star can have more than 90 deg. of right ascension when reckoned by the colures : therefore if to the right ascension of a star from the colure there be added 90 deg. for each quadrant preceding the quadrant the star is upon, it will give the right ascension by the globe.

Ex. (see map, Plate III). 1. What are the right ascension and declination of Menkar ? The technical word is for the right ascension *RAGE*, and r and g represent 43 deg., and for the declination the word is *AGE*, and g represents 3 deg. declination.

2. Required the right ascension and declination of Regulus. For the right ascension the word is *VEX*, and v, x represent 60 deg. right ascension upon the second quad., therefore  $60 + 90 = 150$  upon the globe. For the declination the word is *TIME*, 13 deg. declination.

As most stars are as often referred to by the Greek letters as by names, it may not be improper to insert the Greek alphabet here.

*The Greek Alphabet.*

1. A $\alpha$ Alpha.	9. I $\iota$ Iota.	17. P $\rho$ Rho.
2. B $\beta$ $\epsilon$ Beta.	10. K $\kappa$ Kappa.	18. $\Sigma$ $\sigma$ $\varsigma$ Sigma.
3. $\Gamma$ $\gamma$ $\imath$ Gamma.	11. A $\lambda$ Lambda.	19. T $\tau$ $\top$ Tau.
4. $\Delta$ $\delta$ Delta.	12. M $\mu$ Mu.	20. $\Upsilon$ $\upsilon$ Upsilon.
5. E $\epsilon$ Epsilon.	13. N $\nu$ Nu.	21. $\Phi$ $\phi$ Phi.
6. Z $\zeta$ Zeta.	14. $\Xi$ $\xi$ Xi.	22. X $\chi$ Chi.
7. H $\eta$ Eta.	15. O $\omicron$ Omicron.	23. $\Psi$ $\psi$ Psi.
8. $\Theta$ $\theta$ Theta.	16. $\Pi$ $\pi$ $\varpi$ Pi.	24. $\Omega$ $\omega$ Omega.

*The chief Stars and Constellations of the Northern Hemisphere.*

The following lines shew the right ascension and declination of the chief stars by the technical word at the end of each line, repeated in the *small* letter following.

The numbers before the sentences and the constellations shew their places on the maps and quadrants; the ladders are shewn by the tens, and the steps by the unit figures.

As most of the lines used for shewing the declination and right ascension of the chief stars, contain some fabulous account of the constellations, it is presumed that the mind will not be uselessly burthened with matter unconnected with their mythological history.

*Quadrant First.*

11. The Northern Fish.

12. Andromeda.

This beauty when chain'd told a pitious TALE;

Whom a mother's high praises expos'd to the GALE.  
Tale, 15 deg. R. A. ; Gale, 35 deg. Dec. of Mirach.

To be food for a monster though handsome as **HEBE**,  
Which brave Perseus the warrior subdu'd by his **ART**.

*Hebe*, 28 deg. R. A.; *Art*, 41 deg. Dec. of Almaack.

13. Cassiopeia.

This African queen was distracted with **WOE**,  
The praise of her child did her comforts **ALLOY**.

*Woe*, 8 deg. R. A.; *Alloy*, 55 deg. Dec. of Schedir.

14. ———

21. Cetus and Aries.

The whale is tremendous when excited to **RAGE**,  
And values no strength, nor respects any **AGE**;  
Now the Ram, mov'd by time, has no longer a **HOPE**,  
From the place of the Bull to return to his **HOME**.

*Rage*, 43 deg. R. A.; *Age*, 3 deg. Dec. of Menkar.

*Hope*, 29 deg. R. A.; *Home*, 23 deg. Dec. of Aries.

22. The Triangles and Musca the Fly.

23. Gamma  $\gamma$ , third Greek letter in Perseus.

24. The Rein-deer.

31. Taurus.

The Pleiades in Taurus so fond of the **LYRE**,  
The Hyades to please often play'd for an **HOURL**;  
Vibrations' soft sounds in the melody **DIED**,  
More sweet were the sounds as they flow'd o'er the **TIDE**.

*Lyre*, 54 deg. R. A.; *Hour*, 24 deg. Dec. of Pleiades.

*Died*, 66 deg. R. A.; *Tide*, 16 deg. Dec. of Aldebaran.

32. Perseus and the Head of Medusa.

Brave Perseus the warrior set out with **AURORA**,  
To kill Medusa the Gorgon his mighty arm **ROSE**;  
The Gorgon he slew with a barb in her **RIB**,  
Then cut off her head and rode home to his **ROOF**.

*Aurora*, 44 deg. R. A.; *Rose*, 40 deg. Dec. of Algol Medusa.

*Rib*, 48 deg. R. A.; *Roof*, 49 deg. Dec. of Algenib.

33. Part of Perseus,  $\delta$ , the fourth Greek letter, Delta.

34. Part of the Camelopard.

41. Orion to his girdle attached his WINE.

*Wine*, 82 deg. R. A. of the Girdle.

Orion the fam'd hunter would boast he could COPE

With the toil and fatigues of the field all the DAY,

Encounter the wild beasts in the woods that ABIDE,

Like huge Nimrod of old ; his club was an OAK.

*Cope*, 76 deg. R. A. ; *Day*, 6 deg. Dec. of Bellatrix.

*Abide*, 86 deg. R. A. ; *Oak*, 7 deg. Dec. of Betelgeux.

42. Auriga, the Charioteer.

Auriga the Charioteer is plac'd with a KID,

And a goat on his back, attends on his ROAD ;

This son of the Sun with his steeds could not COPE,

Abased by Jove's thunderbolts rose beyond HOPE.

*Kid*, 76 deg. R. A. ; *Road*, 46 deg. Dec. of Capella.

*Cope*, 79 deg. R. A. ; *Hope*, 29 deg. Dec. of his Heel.

43. Part of Auriga.

44. Cameleopard.

#### Quadrant Second.

11. Canis Minor.

The Dog on his watch will be tempted by NONE,

And when robbers approach will make much ADO.

*None*, 22 deg. R. A. ; *Ado*, 6 deg. Dec. of Procyon.

12. Gemini, the Twins.

Castor could curb the swift steeds of NOTE,

And rule the war horse with uplifted MANE ;

Pollux and Castor embrac'd Jason's HIRE,

And courage 'gainst pirates they often did SHEW.

*Note*, 21 deg. R. A. ; *Mane*, 32 deg. Dec. of Castor.

*Hire*, 24 deg. R. A. ; *Shew*, 28 deg. Dec. of Pollux.

13. Lynx.

14. Part of Cameleopard.

21. Hydra, and Cancer, the Crab.

Cancer, to Lake Lerna to bite Hercules, GOES  
To vex this bold hero, and his courage to AWE.

*Goes*, 30 deg. R. A. ; *Awe*, 8 deg. Dec. of Tegmine.

22. Part of Cancer and the Lynx's tail.

23. Great Bear's head.

24. ———

31. Leo, the Lion.

Leo, king of beasts, in his den will keep DAYS,  
And when taken by man requires time to TAME.

*Days*, 60 deg R. A. ; *Tame*, 13 deg. Dec. of Regulus.

32. Leo Minor, the Little Lion.

33. Ursa Major, the Great Bear.

34. ———

41. The lion's tail was by Egypt's fat BLOATED, 85 deg.  
R. A. 16 deg. Dec. of B.

42. Bear's Foot.

43. Pointers.

As pleased as the bear when freed from the CAGE,  
Sò glad is the sailor, when making his VOYAGE,  
If Dubhe's obscur'd, and does then again COME,  
As a guide for his safety in ocean or LAKE.

*Cage*, 73 deg. R. A. ; *Voyage*, 63 deg. Dec. of Dubhe.

*Come*, 73 deg. R. A. ; *Lake*, 57 deg. Dec. of B.

44. ———

### *Quadrant Third.*

11. Virgo.

12. Virgo, Coma Berenice, Cor Caroli, Charles's heart,  
And the Greyhounds or Canes Venatici.



Between the Greyhounds is Cor Caroli QUIET,  
Which Scarborough made in the heavens to RISE.

*Quiet*, 11 deg. R. A.; *Rise*, 40 deg. Dec. of Cor Caroli.

13. ζ, 2d. mag., the sixth Greek letter in the middle of  
the Bear's Tail, 19 R. A., 56 deg. Dec. of ditto.

14. ———

21. Mons Menalaus, and Arcturus in Boötes.

O'er th' echoing mount Arcturus shines like a MOON,  
No others oppose; the lord of the mountain, HE IS.

*Moon*, 32 deg. R. A.; *He is* 20 deg. Dec. of Arcturus.

22. Boötes.

Boötes every hour in vain pursues MY FOE,  
The Bear as constant flies to shew his task ANEW.

*My Foe*, 39 deg. R. A.; *Anew*, 28 deg. Dec. of Mirach.

23. Part of Draco.

24. ———

31. Serpens, the Serpent.

32. Corona Borealis.

Bacchus gave Ariadne a crown like a LUNE,  
Emblazon'd with stars, all shining and NICE.

*Lune*, 52 deg. R. A.; *Nice*, 27 deg. Dec. of Alphacca.

33. Part of Draco.

34. Ursa Minor, or the Little Bear.

Round the North Pole the Little Bear LIES,  
On the ice he's secure in the midst of the OCEAN.

*Lies*, 50 deg. R. A.; *Ocean*, 72 deg. Dec. of the Little Bear.

41. Serpentarius, the Serpent-bearer.

Serpentarius, the physician, check'd malady's BANE,  
Gave strength to the old, to their days added TIME.

*Bane*, 82 deg. R. A.; *Time*, 13 deg. Dec. of Ras Alhaghus.

42. Hercules.

Hercules in the struggle would to none ever CEDE,  
 His exploits and his valour no hero could EQUAL;  
 But Cupid at last did this hero DEFY;  
 Then engag'd by Omphale his valour was GONE.

*Cede*, 76 deg. R. A.; *Equal*, 15 deg. Dec. of Ras Algethi.  
*Defy*, 69 deg. R. A.; *Gone*, 32 deg. Dec. of ζ.

43. Dragon's head.

Brave Hercules the Dragon's eye did WEAN,  
 And from him took the apples quite ALONE;  
 The deed gave fame to this brave hero's BOW,  
 And rais'd the jealousy of proud JUNO.

*Wean*, 82 deg. R. A.; *Alone*, 52 deg. Dec. of Rastaban β.  
*Bow*, 88 deg. R. A.; *Juno*, 52 deg. Dec. of Etanin.

44. ———

Quadrant Fourth.

11. Taurus Poniatowski and Tail of Aquila, 13 deg.  
 R. A. 15 deg. Dec.

12. Lyra, the Harp.

The Lyre to the shell of the tortoise we OWE,  
 And to Mercury' sinvention the credit MAY PAY.

*Owe*, 8 deg. R. A.; *May pay*, 39 deg. Dec. of Lyra.

13. Part of Draco δ, 18 deg. R. A. 67 deg. Dec.

14. ———

21. Aquila, the Eagle and Dolphin.

The Eagle was esteem'd by Jupiter HOLY,  
 Himself was this bird when he took a fine BOY;  
 To Arion, said the Dolphin, now follow MY WAY,  
 Yourself with your gold, on the dry land to LIE.

*Holy*, 25 deg. R. A.; *Boy*, 8 deg. Dec. of Altair.  
*My way*, 38 deg. Dec. R. A.; *Lie*, 5 deg. Dec. of the Dolphin.

22. Fox and Goose, 29 deg. R. A., 37 deg. decl. and Cygnus the Swan.

The Swan's delicate down ladies prize for a MUFF;

He's the pride of the pond in the grounds of an EARL.

*Muff*, 39 deg. R. A.; *Earl*, 45 deg. Dec. of Deneb.

23. Part of Cygnus,  $\theta$ , the eighth Greek letter.

31. Equuleus, Little Horse's HEAD, R. A. 45 deg., decl. 9 deg.

32. Lacerta, the Lizard, 66 deg. R. A. 45 deg. decl.

33. Cepheus.

Cepheus consented to drive from his ROOF

His beautiful child who sought pity in VAIN.

*Roof*, 49 deg. R. A.; *Vain*, 62 deg. Dec. of Alderamin.

34. Part of Cepheus,  $\beta$ , the second Greek letter.

41. Pegasus, the Flying Horse.

This horse, arm'd with wings from Medusa's blood CAME,

His foot struck the ground and made a spring ONCE;

On Helicon's mount watch'd by muses with CARE,

He's now plac'd in the heav'ns to join the loud QUOIR.

*Came*, 73 deg. R. A.; *Once*, 27 deg. Dec. of Scheat

*Care*, 74 deg. R. A.; *Quoir*, 14 deg. Dec. of Markab.

42. Frederick's glory, 82 deg. R. A. 43 deg. decl.

43. Part of Frederick's glory.

44. Part of Cepheus.

### *Chief Stars and Constellations of the Southern Hemisphere.*

In the northern hemisphere the steps followed from the floor to the ceiling; but in the southern they will follow from the ceiling to the floor.\*

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\* As the method of placing the constellations on the quadrants

*Quadrant First.*

11. Part of Cetus  $\beta$ , the second Greek letter. Deneb Kaitos—to be exposed to the whale of Andromeda it was the FATE OF, 9 deg. R. A. 19 deg. Dec.

12. The Sculptor's shop, 3 deg. R. A. 36 deg. Dec.

13. Phoenix, 4 deg. R. A. 43 deg. Dec. of  $\alpha$ .

14. ———

21. Cetus the Whale.

The sailor in Cetus the barbed iron will INLAY,

He has then to the barb the strong cable to TIE.

*Inlay*, 25 deg. R. A.; *Tie*, 11 deg. Dec. of Baten Kaitos.

22. The Electrical Machine and Fornax Chemica.

23. The Clock and Achernar, the river Po.

On the Po's winding banks I'd wander from HOME,

And view its proud current observing its LAW.

*Home*, 23 deg. R. A.; *Law*, 58 deg. Dec. of Achernar.

24. Hydrus, the Water-snake, 28 deg. R. A. 68 deg. Dec.

31. Eridanus, the river Po, and George's Harp.

32. Part of Eridanus.

33. Rhomboidal Net.

34. ———

41. Lepus the Hare, and Rigel in Orion.

As the timid Hare flies, the dogs snap and BITE,

And quicken her speed to flee from old TOBY,

For his master Orion to take to his CAVE,

Whose orders and will he does strictly OBEY,

*Bite*, 81 deg. R. A. of  $\alpha$  in Lepus; *Toby*, 18 deg. Dec.

*Cave*, 76 deg. R. A.; *Obey*, 8 deg. Dec. of Rigel.

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is the same in both hemispheres, a map for the southern is not necessary. See plate I. fig. 3.

42. Noah's Dove, and the Engraver's Tools.  
 43. Sword Fish, and the Painter's Easel.  
 44. The Table Mountain.

*Quadrant Second.*

11. Canis Major, and the Unicorn.  
 The watchful dog view'd the Nile's coming UP,  
 And warn'd the Egyptians to flee from its TIDE.

*Up*, 9 deg. R. A. ; *Tide*, 16 Dec. of Sirius.

12. Part of Canis Major  $\epsilon$  13 deg. R. A. 29 deg. Dec.  
 13. Ship Argo.

Canopus the Egyptians adored with great JOY,  
 And believed that his pow'r stood quite ALONE.

*Joy*, 5 deg. R. A. ; *Alone*, 52 deg. Dec. of Canopus.

14. ———

21. Part of the Unicorn and the Printing Press.  
 22. Ship Argo and Mariner's Compass.  
 Jason in search of the fleece to Colchis now GOES,  
 And extols the sea-god when that coast he is NEAR ;  
 No compass he had when a storm did ARISE,  
 For this treasure was latent until after AGES.

*Goes*, 30 deg. R. A. of  $\iota$  in Argo Navis ; *Near*, 24 deg. Dec.  
*Arise*, 40 deg. R. A. of the Compass ; *Ages*, 30 deg. Dec.

23.  $\gamma$  3, the third Greek letter in the Ship Argos, 31  
 deg. R. A. 74 deg. Dec.

24. The Flying Fish.

31. Hydra.

Hydra, a monster which all wish'd to LOSE,  
 By Hercules' valour was soon clear'd AWAY.

*Lose*, 50 deg. R. A. of  $\alpha$  1 ; *Away*, 8 deg. Dec.

The Cat is under Hydra,

32. Part of the Ship Argo  $\gamma$  3, 51 deg. R. A. 40 deg. Dec.

33. Part of Charles's Oak,  $\beta$  1, 68 deg. R. A. 69 deg. Dec.

41. The Cup or Bowl, 73 deg. R. A. 17 deg. Dec.

42. The Air Pump, 69 deg. R. A. 32 deg. Dec.

43. Charles's Oak, 69 deg. R. A. 57 deg. Dec.

44. The Chameleon, 85 deg. R. A. 77 deg. Dec.

### Quadrant Third.

11. Corvus, the crow, and Spica in Virgo.

Virgo, with the ancients, was of justice the **TYPE**,  
Of life she's deprived through affection's soft **TIES**.

*Type*, 19 deg. R. A.; *Ties*, 10 deg. Dec. of Spica in Virgo.

12. Centaurus, 18 deg. R. A. 36 deg. Dec.

13. Crux, the cross, 4 deg. R. A. 62 deg. Dec. of magnitude.

14. Southern Fly, 5 deg. R. A. 68 deg. Dec.

21. Libra the Balance.

When Libra with Sol in time past **AROSE**,

The nights and the days were then always **EQUAL**,

But now nights and days which have the like **ARC**,

Are those when the sun with Virgo gets **UP**.

*Arose*, 40 deg. R. A. 15 deg. Dec. of Zuben el Genubi  $\alpha$  2d mag.

*Arc*, 47 deg. R. A. 9 deg. Dec. of Zuben es Chimali  $\beta$  2d mag.

22. Part of the Centaur.

23. Part of the Centaur holding the compasses, 37 deg. R. A. 60 deg. Dec.

24. ———

31. Part of Scorpio,  $\beta$  59 deg. R. A. 19 deg. Dec.

32. Scorpio, the Scorpion, and Lupus the Wolf.

The Scorpion had an **EVIL HEAD**.

*Head*, 65 deg. R. A. 26 deg. Dec. of **Antares**.



33. The Southern Triangle, 57 deg. R. A. 65 deg. Dec. and Euclid's Square.

41. Serpentarius, the Serpent-bearer, 75 deg. R. A. 15 deg. Dec.

42. Part of Scorpio,  $\lambda$  80 deg. R. A. 37 deg. Dec.

43. The Altar, 74 deg. R. A. 56 deg. Dec.

44. Bird of Paradise, 71 deg. R. A. 74 deg. Dec.

*Quadrant Fourth.*

11. Antinöus, 22 deg. R. A. 2 deg. Dec., and Scutum Sobeiski, 7 deg. R. A. 8 deg. Dec.

12. Sagittarius, 13 deg. R. A. 33 deg. Dec. ; Southern Crown, 8 deg. R. A. 40 deg. Dec.

13. Telescope, 8 deg. R. A. 47 deg. Dec.

21. Capricornus the Goat, 32 deg. R. A. 13 deg. Dec.

22. The Microscope, 45 deg. R. A. 36 deg. Dec.

23. The Peacock and Indian, 33 deg. R. A. 57 deg. Dec. of Alpha  $\alpha$ .

24. Hadley's Octant, 40 deg. R. A. 80 deg. Dec.

31. Aquarius, 59 deg. R. A. 1 deg. Dec. of  $\alpha$ , 51 deg. R. A. 6 deg. Dec. of  $\beta$ .

32. The Air Balloon, 50 deg. R. A. 30 deg. Dec.

33. The Crane, 59 deg. R. A. 45 deg. Dec. of  $\alpha$ .

41. Part of Aquarius,  $\delta$  71 deg. R. A. 31 deg. Dec.

42. Southern Fish, or Piscis Australis.

Venus, as a fish, was consigned to the OCEAN,

From the ire of the giant, old Typhon, to GET.

Ocean, 72 deg. R. A. ; Get, 31 deg. Dec. of Fomalhaut.

43. Touchana, the American Goose.

*Solar System.*

The solar system is so called, because the sun is supposed to be placed in a certain point called the centre of

the solar system, having all the planets revolving round him at different distances, and in different periods of time.

In the following verses the diameter of each planet is given in the last word of the first line, the mean distance from the sun in the last word of the second line, the diurnal rotation on its axis in the last word of the third line, and the planet's annual period round the sun in the last word of the fourth line; also, the last word of the second line in each verse shews millions of miles.

The sun is situated near the centre of the orbits of all the planets, and revolves on its axis (a holy star) in 25 days, 14 hours, 4 minutes. (See Keith.)

The sun was observed by the BABYLONIANS—885,220 miles its diameter.

### 1. MERCURY ☿.

Mercury is the least of all the planets whose magnitudes are correctly known, and nearest to the sun; it is seldom to be seen, and when it does make its appearance, it can only be seen a few successive nights or mornings, its daily motion being so very swift, 95,000 miles per hour.

Mercury the messenger deem'd it MATERIAL,  
To bear an emblem of pow'r—the wand or the MACE;  
Of the Gods he was messenger, the ancients did SAY;  
By them being sent his commands WE OBEY.

Diameter of Mercury,	<i>Material</i> ,	3,145 miles.
Mean Distance, . . . .	<i>Mace</i> ,	37,000,000
Diurnal Rotation . . .	<i>Say</i> ,	0 Unknown.
Annual Period . . . .	<i>We obey</i> ,	88 days.

### 2. VENUS ♀.

Venus is the brightest, and, to appearance, the largest of all the planets in the heavens: her light is distinguished

from that of the other planets by its brilliancy and whiteness, which sometimes, in a dusky place, will produce a sensible shadow from an object. When seen through a telescope, she appears to have all the phases of the moon. She is a morning star, or appears West of the sun 290 days; and an evening star, and appears East of the sun, about the same number of days.

Venus is seen from the shores of COLUMBIA,  
And throws her bright rays o'er the waves of the DEEP,  
Meets Sol in the morning, and humbles before HIM,  
Though then Lucifer call'd, her name's not UNHOLY.

Diameter of Venus..	7,538 miles.
Mean Distance ....	69,000,000
Diurnal Rotation....	23 days.
Annual Period ....	225

### 3. EARTH $\oplus$ .

Earth, the figure and magnitude of this planet have, in many places in these pages, been noticed, together with its various circles, &c., therefore we shall only mention its diameter and mean distance from the sun.

Alexander, earth's conqueror, did o'er his CUP DOZE;  
His numbers and pow'r made his enemies FLY.

Diameter of the Earth	7,964 miles.
Mean Distance ....	95,000,000

### 4 MARS $\circ$ .

Mars appears of a dusky red colour, and his light is much duller than that of Venus, though sometimes he is apparently as large as Venus, but never shines with so brilliant a light: from his ruddy colour it is conjectured that he is encompassed with a thick cloudy atmosphere.

Mars the great Nimrod, on our earth RUIN LAYS,  
 Call'd Mars the Avenger—on his enemies TROD;  
 This hunter of man was more cruel than NERO,  
 And most lonely does now spend his drear DAY ABOVE.

Diameter of Mars ..	4,250 miles.
Mean Distance ....	146,000,000
Diurnal Rotation ..	24 hours.
Annual Period ....	686 days.

#### 5. VESTA ♃.

Vesta, on March 29, 1807, was discovered by Dr. Olbers, at Bremen.

Vesta did the Pagans make goddess of FIRE,  
 The source of all life and a flame not UNHOLY;  
 What she desired of Jupiter, he granted with EASE;  
 At Rome and in Greece was adored by GAY HEROES.

Diameter of Vesta ..	94 miles.
Mean Distance ....	225,000,000
Diurnal Rotation ..	0 Unknown.
Annual Period ....	3 yrs. 240 days.

#### 6. JUNO ♀.

Juno of gods was the queen, though unworthy the TITLE;  
 Destruction she hurl'd on Priam IN ILIUM,  
 And razed his fine city where plenty and EASE  
 Smil'd on his sons who were glad their kind SIRE TO MEET.

Diameter of Juno ..	115 miles.
Mean Distance ....	253,000,000
Diurnal Rotation ..	0 Unknown.
Annual Period ....	4 yrs. 131 days.

#### 7. CERES ♀.

Ceres was discovered Jan. 1, 1801, by M. Piazzi, the Astronomer Royal at Palermo: it appears like a star of the 8th magnitude.



Ceres first taught the ground to be till'd with TEAMS,  
 She presided o'er gardens tho' descended from HEAV'N ;  
 Gave laws to the peasant, and shew'd him the USE  
 Of the plough and the Harrow to heighten OUR HONOUR.

Diameter of Ceres .. 130 miles.  
 Mean Distance .... 262,000,000  
 Diurnal Rotation .. 0 Unknown.  
 Annual Period .... 4 yrs. 224 days.

#### 8. PALLAS ♀.

Pallas was discovered by Dr. Olbers, on March 28th, 1802 : it appears like a star of the 7th magnitude.

Lalande, says Pallas, is Olbers, and that is her TITLE;  
 He was first to discover her shining in HEAV'N ;  
 When her station he found, he view'd her with EASE,  
 Though astronomers say we can't take YOUR HINT.

Diameter of Pallas .. 115 miles.  
 Mean Distance .... 262,000,000  
 Diurnal Rotation .. 0 Unknown.  
 Annual Period .... 4 yrs. 221 days.

#### 9. JUPITER ♃.

Jupiter is the largest of all the planets, and notwithstanding his immense distance from the sun and earth, he appears to the naked eye nearly as large as Venus, but less brilliant. Jupiter is bounded by faint rings called zones or belts, which, from their frequent change in number and situation, are supposed to be clouds : his magnitude is 1400 times that of the earth : he is attended by four moons, and travels at the rate of nearly 30,000 miles per hour.

Jupiter,  
 Of Gods the most pow'rful—o'er distress WEEPS ALOUD—  
 Of his bounty and blessing was man the chief REAPER ;  
 Though of troubles and toils he impos'd a hard TAX,  
 Yet to some he distributes a portion QUITE METED.

Diameter of Jupiter.. 89,056 miles.  
 Mean Distance .... 494,000,000  
 Diurnal Rotation .. 10 hours.  
 Annual Period .... 11 yrs. 316 days.

## 10. SATURN ♄.

Saturn shines with a pale, feeble light, being the farthest from the sun of any of the planets that are seen without a telescope. Saturn when viewed with a good telescope, by the singularity of its appearance most commonly engages the attention of the young observer. It is surrounded by an interior and exterior ring, beyond which are seven satellites, all except one in the same plane as the rings: these rings and moons are all opaque, and shine by the light which they receive from the sun. Saturn moves in his orbit at the rate of 22,000 miles per hour.

Saturn,\* call'd Time, with his hands ICY, BECKON;  
 To compute his large ring his mind was not FIX'D,  
 And to reckon his bulk did Ferguson TEASE,  
 While he had his herds, and his stray SHEEP TO CARE.

Diameter of Saturn.. 7,872 miles.  
 Mean Distance .... 906,000,000  
 Diurnal Rotation .. 10 hours.  
 Annual Period .... 29 yrs. 174 days.

## 11. HERSCHEL ♃.

Herschel—this planet was discovered at Bath, by Dr. Herschel, March 13, 1781: it is the most remote of all the planets belonging to the solar system; it is attended by six satellites or moons, and when viewed through a telescope

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\* The ring revolves round Saturn in a plane coinciding with the Equator, and appears most open when his longitude is about 2 signs, 17 deg., or 8 signs, 17 deg.



of small magnifying power appears like a star of the sixth magnitude.

Herschel's renown might compare with a MILTON'S ;  
 He to gaze on the stars an enormous TUBE MADE,  
 To adjust all its angles he found it quite EASY—  
 Then with great satisfaction view'd the comets' BIG TAILS.

Diameter of Herschel,	35,120 miles.
Mean Distance . . . .	1,836,000,000
Diurnal Rotation . .	0 Unknown.
Annual Period . . . .	83 yrs. 150 days.

## 12. MOON D.

The Moon, or Diana, being the nearest of the heavenly bodies to the earth, and next to the sun in her resplendent appearance, has arrested the attention of astronomers in all ages. The ancients used to assemble at the time of new or full moon to perform the obligations of piety and gratitude for the numerous benefits they derived from her. By the sun they measured the year, and by observing the number of days which elapsed between new moon and new moon, they measured their month, and this month they supposed to be completed in 30 days; but after the length of the year was discovered, the ecliptic and all other circles were divided into 360 deg., because  $30 \text{ days} \times 12 \text{ mo.} = 360 \text{ degrees or days}$ .

The lunar month is of two sorts, periodical and synodical; the former being the time that the moon takes to finish her course round the earth, and consists of 27 days, 7 hours, 43 min., and the latter is the time which elapses between new moon and new moon, or 29 days, 12 hours, 44 min.

Diana, the Moon, shines bright on all NATIONS,  
 Her temples the spoils of brave HEROES ADORN,  
 To raise up her altars not a single HOPE TEEMS,  
 Man now looks on the goddess as a bigot's NICE BUOY.

Diameter of the Moon	2,120 miles.
Mean Distance . . . .	240,642
Synodical Month ..	29 days 13 hours.
Periodical Month ..	27        8

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### PROBLEM III.

*To name what Constellations and Chief Stars are passing the Meridian of London at any given Hour on any given Day.*

*Def.* The meridian of any place is a semicircle extending from the North to the South Pole, and cutting the Equator at right angles: at the time the stars pass this line they culminate or south.

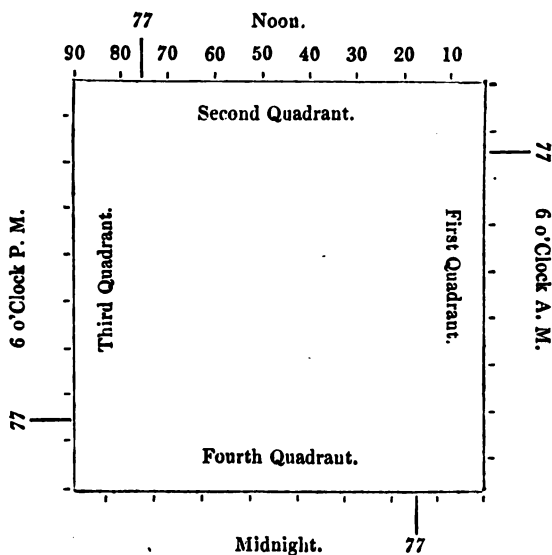
*RULE.* Find the sun's place, or apparent noon, and note the number of degrees; then find with what ladder they correspond: the constellations and chief stars on that ladder will be South: turn to the same ladder on the quadrant to the left; those constellations and chief stars will be on the meridian at 6 in the evening, the same ladder on the opposite quadrant will be on the meridian at midnight, and the same ladder on the quadrant to the right hand of noon will be on the meridian at 6 in the morning.

Although the sun apparently moves in the Ecliptic, yet when we speak of the sun's place, or noon, we invariably refer to the Equinoctial, or that degree of it which accords with the sun's place at noon.

Since the Earth performs a revolution on its axis in 24 hours, the meridian of any place will pass every part of the heavens during that time, because each quadrant is equal

to six hours of time, or 90 degrees; viz. 90 degrees will appear to pass during the first six hours after noon, 90 deg. more during the next 6 hours after six in the evening, 90 deg. more during the next six hours after midnight, and 90 deg. more after the next six hours after six in the morning—in which time the earth will have made a complete revolution on its axis, and have advanced one degree more in the Ecliptic; and thus all the stars to England's view, in the vast concave, apparently will have culminated during that time.

Hence it will be seen that as 90 deg. of right ascension are between the noon and 6 o'clock hour-lines, when the sun's right ascension or noon upon any quadrant is found, the same degree on the next quadrant, to the left, is 6 in the evening; the same degree on the quadrant to the right, 6 in the morning; and the same degree on the opposite quadrant is midnight: hence, as soon as noon for any day is found, the other three points are instantly known, and for any other hour before or after noon. Midnight, 6 in the evening, or 6 in the morning, turn to the right or left hand as the time may be before or after the time of the hour-line, observing always to turn to the left when after, and to the right when before the hour-line. These four hour-lines afford a most certain and ready method of finding the time at which the various constellations and chief stars culminate on any day of the year. The imaginary hour-circle will be better understood by the annexed figure and following example; it will be seen, as soon as noon is found, the other lines instantly present themselves, as the hour-circles cannot change in respect to each other.



This figure shews that the four quadrants are divided into 24 hours; the 12 and 6 o'clock hour-lines fall upon the same degré and ladder on each quadrant. Hence, to find the constellations, which will be on the meridian at any hour, after having found noon, the pupil knows that the six and twelve o'clock circles are on the same degree of the quadrant opposite, and to the right and left of noon. If the given hour should not fall upon one of these lines, he has only to remove as many degrees to the right or left hand of the hour-line as are equal to the difference of time\* between the given hour and the hour-line, observing, if the

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\* To turn time into degrees, &c., see p. 145.



time be after, to turn to the left, and if before the hour-line, to turn so many degrees to the right hand; and those stars, which have their right ascension agreeing with the given hour, will be southing or on the meridian.

*Ex.* Find what constellations are culminating at one o'clock in the afternoon, 9 in the evening, and 4 o'clock in the morning, on September 8th.

The sun has been 16 days in Virgo, and lost one of right ascension, which makes 15 deg. in Virgo; then  $62 \text{ deg.} + 15 \text{ deg.} = 77 \text{ deg.}$  upon the second quadrant is the sun's right ascension for noon; then

77 deg. on the second quadrant is noon;

77 deg. on the third quadrant is 6 in the evening;

77 deg. on the fourth quadrant is midnight;

77 deg. on the first quadrant is 6 in the morning.

77 deg. upon the second quadrant is apparent noon, and one o'clock in the afternoon will be 1 hour, or 15 deg. on the left of 77 deg. or noon; thus  $77 + 15 = 82 \text{ deg.}$ ; this degree will fall upon the fourth ladder of the 1st quadrant, and is the part of the heavens, culminating at that hour: the constellations upon the fourth ladder are, Lepus, Orion, Auriga, and the Camelopard.

77 deg. upon the third quadrant is 6 in the evening, and 3 hours after, or 45 deg., will be 9 in the evening; then  $77 + 45 = 122 \text{ deg.}$ , or 32 deg. on the fourth quadrant; this degree falls on the second ladder of the fourth quadrant, and the constellations culminating are, Capricornus, the Dolphin and Eagle, Fox and Goose, and Cygnus.

77 deg. upon the first quadrant is 6 in the morning, and 2 hours before, or 30 deg. to the right of 77 deg. on the first quadrant, will be the part of the Equinoctial South at 4 in the morning: then  $77 - 30 = 47 \text{ deg.}$ ; this degree falls

on the third ladder on the first quadrant, and the constellations on it are, the Whale, Ram, Fly, Triangles, part of Perseus, and the Reindeer.

*Obs.* 1. A semicircle, cutting the Equinoctial in the point of the given hour, passes every star and constellation which is due South at that time.

2. As the pupil knows the constellations southing at a given hour, he can also name the chief stars which are nearly culminating at that time.

3. If the 1st or 2d, or any other ladder of one quadrant be South, the bottom of the corresponding ladder to the left will be rising; the bottom of the corresponding ladder to the right will be setting; and the whole of the same ladder on the opposite quadrant will be due North.

*What Constellations and chief Stars are passing the Meridian of London on the following Days and Hours?*

Hour.		Hour.	
22 March,	12 A. M.	22 June,	12 A. M.
24 Sept.,	12 A. M.	23 Dec.,	12 A. M.
20 April,	12 A. M.	21 May,	12 A. M.
23 July,	12 A. M.	23 August,	12 A. M.
22 Nov.,	12 A. M.	20 Jan.,	12 A. M.
19 Feb.,	12 A. M.	27 March,	2 P. M.
27 March,	6 P. M.		12 P. M.
	6 A. M.	27 April,	10 A. M.
23 Oct.,	12 A. M.	30 June,	12 A. M.
6 August,	12 A. M.	6 August,	6 P. M.
	12 P. M.		6 A. M.
24 Sept.,	5 P. M.	27 Nov.,	7 A. M.
29 Oct.,	4 P. M.	26 Dec.,	6 P. M.
2 June,	3 P. M.	24 Jan.,	3 A. M.



	Hour.		Hour.
4 March,	5 P. M.	7 June,	$7\frac{1}{2}$ P. M.
3 July,	$4\frac{1}{2}$ A. M.	11 August,	9 P. M.
12 Dec.,	7 A. M.	14 July,	11 P. M.
17 June,	6 A. M.	18 Oct.,	7 P. M.

## PROBLEM IV.

*To find when any Star will come to the Meridian or Culminate.*

**RULE.** Find first the sun's right ascension upon the quadrant or season of the given day, and this degree is the sun's place on the meridian at noon. It has been shewn before that the 6 and 12 o'clock hour circles will fall upon the same ladder and same degree of the opposite quadrants, therefore to know the time at which a star will culminate, the pupil must find the number of degrees that the star is, to the left or right hand of the hour circle on the quadrant on which the star is situated: these degrees he will turn into time: then if the star be on the left of the hour circle, the degrees turned into time he must add to the hour-line, and if to the right of the hour-line, the time must be taken from the hour-line for the required time.

**Obs.** As soon as noon is determined, always transfer the hour circle to the quadrant on which the star is situated.

**Ex.** At what times will the following stars pass the meridian on May 11th, viz. Menkar, Regulus, Arcturus, and Lyra?

$10 + 11 + 1 + 28 = 50$  deg., the sun's right ascension.

50 deg. on the first quadrant is noon.

50 deg. on the second quadrant is 6 in the evening.

50 deg. on the third quadrant is midnight.

50 deg. on the fourth quadrant is 6 in the morning.

Those stars on the first quadrant, with less than 50 deg. of R. A. on it, will pass the meridian before noon, and those, with more than 50 deg. of R. A. will culminate after noon. Those stars on the second quadrant will culminate before or after 6 in the evening, according as their right ascension is more or less than 50 deg. Those stars on the third quadrant will culminate before or after midnight as their R. A. is more or less than 50 deg.; and those stars on the fourth quadrant will pass before or after 6 in the morning, according as their right ascension is more or less than 50 deg.

Menkar is 43 deg. on the first quadrant.

50 deg. on the first quadrant is noon. Menkar will culminate before noon, because it is 7 deg. on the right of the 12 o'clock hour circle or noon : 7 deg. turned into time will be 28 minutes, the time Menkar culminates before noon, or 32 minutes past 11 in the morning.

Regulus is 60 deg. on the second quadrant.

50 deg. upon the second quadrant is 6 in the evening; Regulus will culminate therefore after 6 in the evening, being 10 deg. to the left of the hour circle : then 10 deg. turned into time are 40 minutes; hence Regulus culminates 40 minutes after 6 in the evening.

Arcturus is 32 deg. on the third quadrant.

50 deg. upon the third quadrant is midnight; then Arcturus will culminate before midnight, being 18 deg. to the right hand of midnight's hour-line; and 18 deg. turned into time will be 1 hour 12 minutes before midnight, or 48 minutes past 10 o'clock at night.

Lyra is 8 deg. on the fourth quadrant.

50 deg. upon the fourth quadrant is 6 in the morning ; then Lyra culminates before 6 in the morning, being 42 deg. to the right of the 6 o'clock hour-line, and this turned into time will be two hours 48 minutes, or 12 minutes past 9 in the evening.

*Remarks.*

1. The quadrants or walls, with respect to the earth's motion, receive their names, of the Noon quadrant, 6 in the Evening, 6 in the Morning, and the Midnight quadrant, according to the wall or quadrant that the sun may be on at noon.

2. Every star has a celestial meridian ; this line passing through the star and the poles coincides with the hour circle at the hour the star souths.

3. Lines drawn through the centre of the floor from opposite quadrants point out the same hours, but at opposite parts of the day.

4. An imaginary hour circle is attached to the imaginary Equinoctial sun, and the student with his hand (the index of the hour circle before him) points to noon at the time he views the sun's place ; then turning Eastward, with his hand still pointing to the sun, and looking upon the stars on the quadrants or walls, he can point out the hours at which they culminate—that point of the great arch at which any heavenly body arrives at its greatest height or altitude.

1. At what hour will Aldebaran south on June 17th ?

2. Find the time at which Vega or Lyra culminates, March 29th.

3. At what hour will Capella come opposite Greenwich, June 25th ?

4. At what hour will Pollux be due South on Jan. 2d ?

5. July 29, in London I saw Altair south ; what was the time ?
  6. Arcturus was on the meridian of London, June 25th, how much after noon ?
  7. Find what time Arietis comes to the meridian, June 28th.
  8. When Markab culminates, January 29th, what is the time ?
  9. April 24th, Aldebaran comes to the meridian in the afternoon ; at what hour ?
  10. At the summer Solstice, when will Alphacca south ?
  11. At what time will Regulus culminate when the sun is in Aries ?
  12. On that day in September when the days and nights are equal, what is the time when Arcturus is on the meridian ?
  13. On July 24th, at what time will Altair culminate ?
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#### PROBLEM V.

*To find on what Day of the Year any Star will culminate at a given Hour.*

**RULE.** Find the nearest 6 o'clock or 12 o'clock hour circle to the given hour, and if the nearest circle be not noon, then find the degree of the Equinoctial South at noon ; also find the day of the month when the sun has this R. A. by Problem II. for the required day.

On what day of the month will Regulus culminate at 4 o'clock in the afternoon ?



Because the star is upon the meridian at four in the afternoon, and is 60 deg. on the second quadrant, 60 deg. on the second quadrant must be South at 4 in the afternoon: the sun had passed the meridian at that time 4 hours or 60 deg. towards the West, hence the sun at noon was 60 deg. to the right hand of the star's place on the second quadrant, which makes the first deg. of the second quadrant, or the first degree of Cancer—and the corresponding day is the 21st of June.

On what day of the month will Altair culminate at 5 in the afternoon?

Altair is 25 deg. on the fourth quadrant, therefore 25 deg. on the fourth quadrant was South at 5 P. M.; adding 1 hour or 15 deg. to 25 deg. it will make 40 deg., then 40 deg. on the fourth quadrant is the 6 in the evening hour-circle, and 40 deg. on the third quadrant is noon, therefore,  $40 \text{ deg.} - 28 = 12 \text{ deg.}$  in Scorpio, which answers to the 5th day of October.

### *Remarks.*

1. It is obvious, from the proposition, that the student must always suppose he is looking due South at the given hour: and also, first, he must consider whether the sun be East or West of the meridian at the time, and how many degrees distant from it to the right or left, which is easily known by turning the hours before or after noon into degrees.

2. When a star is culminating, and the hour known, the sun's right ascension for that day is also known.



*Find the Days of the Month when the following Stars will culminate at the following Hours?*

Stars.

1. Aldebaran ..at 2 A. M. and 9 P. M.
2. Procyon ....at 8 A. M. and 7 P. M.
3. Arcturus ....at 3 A. M. and 7 P. M.
4. Altair .....at Noon and 4 P. M.
5. Capella ....at 5 A. M. and 3 A. M.
6. Orion's Belt, at  $4\frac{1}{2}$  P. M. and 4 A. M.
7. Alphacca....at 5 P. M. and 11 P. M.
8. Vega ....at 7 P. M. and 5 A. M.
9. Menkar ....at 8 P. M. and 6 A. M.
10. Dubhe.....at 3 P. M. and 4 A. M.
11. Regulus ....at 6, 24, A. M. and 5 P. M.
12. Castor .....at 9, 20, Morning.

13. 1728. James Cook, the circumnavigator, expired on the day when Arcturus and the sun culminated together; what was the day of the month?

14. Sir Walter Raleigh was decapitated in 1618, when the star Alphacca culminated at 1 hour 12 minutes in the afternoon; required the day of the month.

15. In 1736, Don Ulloa left Quito, where he had been to measure a degree of the meridian, on the day when Altair culminated at 6 hours 40 minutes in the evening: he arrived at Carthagená the year before, when the same star culminated at 28 minutes past midnight; required the two days of the year,

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## PROBLEM VI.

*To find what Stars are culminating in any given Longitude, the Day of the Year, and the Hour at London, being given.*

**RULE.** Find the sun's right ascension for the given day, and the part of the Equinoctial on the meridian at the given hour : then if the place be in East \* longitude, turn as many degrees as are equal to the longitude to the left of the given hour, and this degree will be culminating to the given place, and those stars upon the ladder answering to this degree will be culminating to that place ; but if the place be in West longitude, then remove as many degrees to the right of the given hour as the place has degrees of longitude West, and those stars whose right ascension agrees with the degree of the Equinoctial South, at the given hour, will be culminating to the given place.

1. At seven o'clock in the evening at London, August 2, what constellations are passing the meridian of Petersburg ?

$9 + 2 + 32 = 43$  deg. upon the second quadrant is noon ; 43 deg. upon the third quadrant is 6 in the evening, and 15 deg. more will make 58 deg. upon the third quadrant for 7 o'clock in the evening South to London ; and as the longitude of Petersburg is 30 deg. East, we must add 30 deg. to  $58 = 88$  deg. on the third quadrant upon the meridian of Petersburg at 7 in the evening ; and the constellations agreeing in right ascension with this degree, are Serpentarius, Hercules, and Draco's Head.

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\* To all places East of London, a star will culminate before it will at London, and to all places West of London it will pass the meridian after it has passed that of London.

2. What constellations are on the meridian of Mexico, November 4th, when the clocks at London are 3 P. M. ?

$8 + 4 = 12$  deg., the sun is 12 deg. in Scorpio, and on entering Scorpio it is 28 deg., therefore  $28 \text{ deg.} + 12 \text{ deg.} = 40 \text{ deg.}$  on the third quadrant is noon ; and 3 hours or 45 deg. after 40 deg., will be 85 deg. on the third quadrant for 3 in the afternoon at London. Now, as Mexico is 99 deg. West, if 3 P. M. at London be 85 deg. from Libra, it is 175 deg. from Cancer ; then  $175 \text{ deg.} - 99 \text{ deg.} = 76 \text{ deg.}$  upon the second quadrant for 3 P. M. at Mexico ; and the constellations South are part of Hydra, Crater, Leo's Tail, the Bear's Foot, Pointers, and the Tail of Draco.

*Note.* The right ascension of the meridian is that degree of the Equinoctial which is upon the meridian at any given hour.

Places.	Long.	Deg.	Hour.
3. Lima.....	76° 55' W.	Aug. 27,	5 P. M.
4. Naples .....	14 12 E.	Aug. 27,	5 P. M.
5. Pekin .....	117 27 E.	Sept. 29,	3 A. M.
6. London.....	0 5 W.	June 29,	3 P. M.
7. Quebec.....	71 10 W.	Oct. 29,	6 P. M.
8. Cape Horn ..	67 21 W.	July 27,	4 P. M.
9. Aleppo.....	37 10 E.	Oct. 24,	7 P. M.
10. Goa .....	73 57 E.	Nov. 24,	8 A. M.
11. Buenos Ayres,	58 16 W.	Dec. 17,	11 P. M.
12. Cork.....	8 30 W.	April 27,	4 P. M.
13. Dantzic. ....	18 38 E.	May 22,	6 P. M.
14. Bombay ....	73 0 E.	May 29,	3 A. M.
15. Charlestown,	79 52 W.	Feb. 20,	10 $\frac{1}{2}$ A. M.
16. Moscow ....	37 33 E.	March 24,	9 P. M.
17. Mexico.....	99 5 W.	July 29,	1 P. M.
18. Tunis .....	10 11 E.	Aug. 10,	4 A. M.

Places.	Long.	Day.	Hour.
19. Rio de Janeiro,	43 3 W.	May 22,	6 P. M.
20. Syracuse ....	15 25 E.	June 22,	7 P. M.
21. York.....	1 6 W.	June 27,	3 P. M.
22. Paris.....	2 20 E.	March 25,	6 P. M.

23. Nice, a city of Italy, on the Mediterranean, longitude  $7\frac{1}{4}$  deg. East : here on May 8, 1758, was born Marshal Massena, who died April 4th, 1817. Name the constellations passing the meridian of Nice at 6 evening, on the two days mentioned, and the constellations at the East and West points of the horizon.

24. Rome nearly 13 deg. E. : in 1807 here died Angelica Kauffman, styled the "Paintress of the Soul;" find what constellations were on the meridian at 9 in the evening, what were due North, and what was at the West point of the horizon.

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### PROBLEM VII.

*To find the Meridian Altitude of any given Star at any Place.*

**RULE.** If the latitude of the place be North, and the declination of the star be North, then add the declination of the star to the complement\* of latitude of the given

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\* Complement of latitude is what the latitude wants of 90 deg.

1. When a star is on the North meridian, its polar distance must be taken from 90 deg. for its altitude.

2. If the declination of a star be greater than the latitude of the place, then add the polar distance of the star to the latitude for the meridian altitude.

place for the altitude ; but if the latitude and declination be one North and the other South, from the complement of latitude subtract the declination of the star for the altitude required.

Ex. 1. What is the meridian altitude of Menkar at London ?

Lat.	Comp.	Dec.	Merid. Alt.
90 deg.—51½ deg.	=38½ deg.	+3 deg.	=41½ deg. at London.

Ex. 2. What is the meridian altitude of Antares at Petersburg ?

Lat.	Comp.	Dec.	
90 deg.—60	=30	—26	=4 deg. meridian altitude of Antares.

Ex. 3. What is the meridian altitude of Alphacca at Quito ?

Comp.	Merid. Alt.
90 deg.—0 deg. 13'	=89 deg. 47'—27'=62 deg. 47' of Alphacca.

### *Remarks.*

1. Stars with the same declination as the latitude of any place are vertical to that place when on the meridian.

2. The altitude of a star is an arc of a vertical circle, intercepted between the centre of the star and the horizon.

3. The Prime Vertical is that Azimuth circle which passes through the East and West points of the horizon.

4. Azimuth circles pass through the Zenith and the Nadir, cutting the horizon at right angles ; these circles measure the altitudes of celestial bodies.

What is the meridian altitude of the following stars at the following places ?



Stars.	Places.	Lat.	
1. Arcturus.....	Petersburgh.....	60	N.
2. Ditto .....	Bender .....	47	
3. Ditto .....	Cairo .....	$30\frac{1}{2}$	
4. Ditto .....	Constantinople ..	$41\frac{1}{2}$	
5. Regulus .....	London .....	$51\frac{1}{2}$	
6. Ditto .....	Naples .....	41	
7. Ditto .....	Quebec .....	$46\frac{1}{2}$	
8. Ditto .....	Algiers .....	$36\frac{1}{2}$	
9. Ditto .....	Mecca .....	22	
10. Ditto .....	Turin.....	45	
11. Capella .....	Rome.....	42	
12. Ditto .....	Cape Verd .....	15	
13. Ditto .....	Teneriffe .....	28	
14. Ditto .....	Madrid .....	$40\frac{1}{2}$	
15. Ditto .....	Otaheite.....	$17\frac{1}{2}$	S.
16. Ditto .....	Quito .....	$\frac{1}{4}$	
17. Ditto .....	Lima .....	12.	

18. Frejus, in France, was the birthplace of the great Roman General Agricola, it was their Forum Julii, latitude  $43\frac{1}{2}$  deg.; in what part of the heavens did Altair acquire its greatest height, and what was it when passing this place?

19. New Zealand was discovered by Tasman, in December 1642,\* and in 1770 Captain Cook visited and circumnavigated it. He found it to consist of two large islands; he afterwards planted many sorts of garden seeds. When it was discovered was it winter there? What were the altitudes of the sun, Menkar, and Regulus, when on the meridian?

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\* See Bourn's Gazetteer.

## PROBLEM VIII.

*To find the Latitude of a Place by knowing the Meridian Altitude of the Sun or a Star whose Declination is contrary, or if of the same name, less than the Latitude of the Place required.*

**RULE.** Subtract the declination\* from the Meridian altitude, the remainder is the complement of latitude, which take from 90 deg. for the latitude, if the declination be North, and if South, add the declination of the star to the Meridian altitude, and the sum is the complement of latitude, which take from 90 for the latitude required.

1. What is the latitude of Petersburg if when Arcturus pass the meridian of that place it is seen 50 deg. of Altitude ?

Alt. dec. comp.

50—20—30 and 90—30=60 lat. required.

What is the latitude of the following places if the following stars have altitudes, as under, at them ?

Stars.	Merid. Alt.
1. Bender, Regulus . . .	56 deg.
2. Cairo, Menkar . . .	62
3. London, Bellatrix . . .	44½
4. Mecca, Procyon . . .	74
5. Rome, Aldebaran . . .	64
6. Turin, Arcturus . . .	65

7. Gustavus 3rd, king of Sweden, was assassinated on March 16, 1792, at a place in 18 deg. E. long., and Regulus, when culminating, was seen 44 deg. above the South horizon ; what was the place ?

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\* To find the sun's declination, see p. 152.

8. Jan. 6, the Eastern sages visited our Saviour at Bethlehem, when the heavens presented the most extraordinary appearance ever beheld: if they saw the star Aldebaran 74 deg. of meridian altitude on that night, in what latitude were they?

9. The crusaders, July 5, 1100, took a city: about a quarter past nine in the evening, in longitude 35 deg. East, they saw a bright star 7 deg. beyond the zenith on the North meridian, or 83 deg. from the North horizon; required the star and the latitude of the place.

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#### PROBLEM IX.

*To find what Constellations and Chief Stars are above the Horizon at any Hour on a given Day.*

RULE. Find what degree of the Equinoctial is South at the given hour: and as the heavens are divided into four cardinal points, these four points will be for the East and West 90 degrees each from the point or degree South, and the North directly opposite to the degree South. As the zenith is always 90 degrees from the horizon, every place having North latitude will have a certain portion of the Equinoctial below the horizon from the East and West points northward; and from the East and West points southward, the same portion of the Equinoctial will be above the horizon; also the part depressed to the North, and the part elevated to the South, will always be equal to the complement of latitude. Hence, to be able to name the constellations above the horizon, there must be an allowance made for the elevation or depression of the Equi-

noctial upon each of the ladders : as there are four ladders upon each quadrant, there will be four ladders between each cardinal point of the compass. The student will commence at the East and West points to make a proportional allowance for the elevation or depression of the Equinoctial, because it cuts the horizon in these two points : for the first ladder, beginning at the East and West points, he will allow for the depression or elevation\* of the Equinoctial 15 deg., for the second ladder, 27 deg., for the third ladder, 35 deg., and for the fourth ladder,  $38\frac{1}{2}$  deg., the complement of latitude of London : and having ascertained the part where the horizon commences, it will be easy to name the stars at this point. See Plate 1, Fig. 1.

Ex. What chief stars and constellations are above the horizon of London on March 27th at 8 in the evening ?

The sun's R. A. or apparent noon is 6 deg. on the first quadrant ; 6 deg. on the second quadrant is 6 in the evening, and 30 deg. more or 36 deg. on the second quadrant, is South at 8 in the evening.

Deg.

Then 36 upon the second quadrant is the South point of the horizon.

36 upon the third quad. is the East point of ditto.

36 upon the first quad. is the West point of do., and

36 upon the fourth quad. is the North point of ditto.

Now 36 deg. being about the middle of the second ladder on each of the quadrants, the stars at the verge of the horizon need only be pointed out. 36 deg. on the third quadrant is the East point of the horizon, and upon the first ladder,

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\* In South latitudes, part of the Equinoctial will be above the horizon from the East and West points northward, and below the horizon from the same points southward.

† See Plate II. fig.

from the East point, towards the South, will be Spica, in Virgo, a little above the horizon; upon the second ladder, Corvus and the Crater; upon the third ladder, part of Hydra and the Air Pump; upon the fourth ladder, the Mariner's Compass. 36 deg. upon the first quadrant is the West point of the horizon—then upon the first ladder from the West point towards the South is Eridanus, upon the second ladder, the Sceptre; upon the third, Lepus and Canis Major, and upon the fourth, a part of Argo Navis. 36 deg. upon the fourth quadrant is the North point. As much as the Equinoctial is elevated at the South point, so much it is depressed at the North point: then, upon the first ladder from the North point towards the East are Cygnus and Lyra; upon the second ladder, Hercules; upon the third ladder, the Northern Crown; and upon the fourth ladder, Boötes. Upon the first ladder from the North point towards the West is part of Cygnus; upon the second ladder, the Lizard and part of Andromeda; upon the third, the Northern Fish; and upon the fourth, Aries and Cetus.

Find what constellations will be above the horizon on the following days and hours:

March 29, at 6 P. M.	August 5, at 3 A. M.
May 28, at 7 A. M.	Sept. 9, at 9 P. M.
June 27, at 8 P. M.	Nov. 11, at 3 A. M.
July 24, at 5 P. M.	Dec. 12, at 7 P. M.



## PROBLEM X.

*To find the Hour at London, when any given Star will pass the Meridian of any given Place on any given Day.*

**RULE.** Find the time of the star's culminating to England, and the longitude of the place turned into time and taken from the time at London, if the longitude be East, but added to the time at London if it be West, for the time required.

**Ex. 1.** At what hour at London will Menkar be upon the Meridian of Petersburg on May 27th ?

The sun is 6 deg. in Gemini ; then 6 deg. + 58 deg. = 64 deg., and 64 deg. on the first quadrant is noon ; then the star will pass the meridian of England before noon 64 deg. — 43 deg. = 21 deg., or 1 hour 24 min. before noon, or 10 hours 36 min. in the morning ; the longitude of Petersburg is 30 deg. E. = 2 hours ; then this, taken from 10 hours 36 min., will make 8 hours 36 min. in the morning.

**2.** At Rio de Janeiro 43 deg. W., at what hour at London will Regulus culminate on June 30th ?

The sun is Cancer 9 deg. ; then 9 deg. on the second quadrant is noon ; and 60 deg. — 9 deg. = 51 deg. = 3 hours 24 min. past noon : the longitude of Rio de Janeiro is 43 deg. W. = 2 hours 52 min., which will make 6 hours 16 min. in the afternoon.

What is the time at London when the following stars will be on the meridian at the places and days as under ?

- |                 |           |            |
|-----------------|-----------|------------|
| 3. Petersburg.. | Procyon,  | July 24th. |
| Calcutta .....  | Altair .. | Aug. 30th. |
| Mexico .....    | Lyra ..   | Nov. 25th. |
| Paris .....     | Sirius .. | Mar. 29th. |
| Dublin.....     | Markab .  | June 12th. |

Moscow .... Regulus May 23rd.  
Tornea .... Denebola, Dec. 22nd.  
Stockholm .. Castor.. Nov. 12th.  
Amsterdam .. Pollux.. Oct. 29th.  
Warsaw .... Betelguex Sep. 27th.

13. Carthage,  $10\frac{1}{2}$  E., the present Tunis ; at what hour at London was Regulus upon the meridian of Tunis ? What constellation was at the East point of the horizon, and what at the West, July 29, at 8 P. M. ?

14. St. Helena Island, 6 deg. W., was discovered Aug. 18, 1502, and was so named from the discovery on the anniversary of St. Helena ; what was the time at London when Arcturus culminated there on that day ?

15. Trincomale, Aug. 26, 1795, in the isle of Ceylon, was captured by the English when Aldebaran was culminating ; what was the time at London, the longitude being 81 deg. East ?

At Jerusalem, long. 35 deg. E., on June 21st, Regulus culminated at 40 min. past 1 P. M. London time ; my clock was 5 P. M. ; was it correct ?

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## A TABLE

*Of the Sun's Semidiurnal Arcs, or of a Star's visible half-duration above the Horizon in the Latitude of London.*

NORTH DEC.			SOUTH DEC.		
Deg.	Semidiurnal Arcs.		Deg.	Semidiurnal Arcs.	
	hrs.	min.		hrs.	min.
0	6	4	0	6	54
1	6	9	1	5	58
2	6	14	2	5	53
3	6	19	3	5	48
4	6	24	4	5	43
5	6	29	5	5	38
6	6	34	6	5	33
7	6	39	7	5	28
8	6	44	8	5	23
9	6	49	9	5	18
10	6	54	10	5	13
11	7	0	11	5	7
12	7	6	12	5	1
13	7	11	13	4	57
14	7	17	14	4	51
15	7	23	15	4	45
16	7	29	16	4	39
17	7	35	17	4	33
18	7	41	18	4	27
19	7	47	19	4	21
20	7	53	20	4	15
21	8	0	21	4	8
22	8	7	22	4	1
23	8	14	23	3	54
24	8	21	24	3	52

The semidiurnal arcs of all celestial bodies are the same if their declinations agree.

In the annexed Table, it will be seen that when the sun or a star has no declination, the semidiurnal arc is 6 hours 4 min., and that for every degree more of declination to the 10th degree, there is a difference of 5 minutes more of time for North declination, and 5 minutes less for South declination. And from the 10th to the 20th degree, the difference of increase and decrease is 6 minutes of time. Also, from the 20th, the difference is 7 minutes of time for each degree.

Degrees of Dec.	Semidiurnal Arcs. Hrs. Min.	Increase of each Deg.
0	6 4	5 minutes.
11	7 0	6
21	8 0	7

The ascensional difference is the time that the semidiurnal arc is more or less than six hours. The ascensional difference of the sun is the time that it rises before, or sets after, 6 o'clock.

*To Compute the Ascensional Difference\* and the Semidiurnal Arc of the Sun or a Star with less than 24 deg. of Declination.*

**RULE.** Of the three portions of declination, 0 deg. 11 deg. 21 deg., find which of these is next less to the declination given of the sun or star, and multiply their difference by the minutes of increase or decrease of a degree of declination, and this product add to the semi-diurnal arc corresponding to the next less number for the semi-diurnal arc required: subtract 6 hours from the semi-diurnal arc for the ascensional difference of the sun or star.†

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\* The ascensional difference increased 1-7th will give the amplitude nearly for England.

† The semi-diurnal arc of the sun is the time of its setting, which double for the length of the day, and double the time of rising for the length of the night.

*Ex. 1.* What are the semi-diurnal arc and ascensional difference of Arcturus ?

The declination is 20 deg. North, and the next less is 11 deg., and the increase 6 minutes for each deg. Then

$$\begin{array}{rcl}
 & \text{deg.} & \\
 & 20 & \\
 & 11 & \\
 \hline
 & 9 & \text{Diff.} \\
 & 6 & \\
 \hline
 & 54 & \text{To which add for} \\
 \text{deg.} & \text{ho.} & \\
 11 \dots 7 & : & 0 \\
 \hline
 & 7 : 54 & \text{Semi-diurnal arc.} \\
 & 6 & \\
 \hline
 & 1 : 54 & \text{Ascensional diff.}
 \end{array}$$

*Ex. 2.* Find the semi-diurnal arc and ascensional difference of Altair.

The declination of Altair is 8 deg. North, the next less to this is 0 deg., and the increase is 5 minutes to a degree ; then

$$\begin{array}{rcl}
 & \text{deg.} & \\
 & 8 & \\
 & 0 & \\
 \hline
 & 8 & \text{Diff.} \\
 & 5 & \\
 \hline
 & 40 & \text{Ascensional diff., to which add for} \\
 \text{ho.} & & \\
 0 = 6 : & 4 & \\
 \hline
 & 6 : 44 & \text{Semi-diurnal arc,}
 \end{array}$$



Find the semi-diurnal arcs of Arietis, Aldebaran, Bellatrix, Betelgeux, Procyon, Regulus, Denebola, Arcturus, and Markab.

Find the semi-diurnal arcs of the sun, the length of the day and night on June 21, May 21, May 29, April 20, Aug. 24, Sep. 26, and Dec. 22.

### PROBLEM XI.

*To find the Time at which a Star rises or sets on a given Day of the Year.*

**RULE.** Find the time of the star's culminating, and from it subtract the semi-diurnal arc of the star for the rising, and add the semi-diurnal arc to the culminating for the time of setting.

*Ex.* At what time will Regulus rise on March 29?

Regulus is 13 deg. declination, and 11 deg. is the nearest less; then  $13 - 11 = 2$  deg.  $\times 6 = 12$  min., then 7 ho. 12 min. the semi-diurnal arc.

On March 29 the sun's R. A. is 8 deg. on the first quadrant or noon.

deg.

8 on the 2d quadrant, 6 in the evening.

The star is 60 on the 2d quad.

—  
15)52

— ho. min.

3 : 28 after 6, or 9 : 28 in the evening it culminated.

M 3

Ho. Min.

Then from 9 : 28 Southing

Take . . . . 7 : 12 Semi-arc.

---

2 : 16 Time of rising on March 29.

The student will readily comprehend the nature of this Problem by supposing that he sees Regulus on the meridian, and knowing the semi-diurnal arc of Regulus to be 7 ho. 12 min., he knows that 7 ho. 12 min. before it culminated it was at the eastern verge of the horizon ; therefore it will be obvious that to find the rising the  $\frac{1}{2}$  arc must be taken from the time of culminating, and added for the time of setting. See Plate 1, Fig. 1.

At what time will the following stars rise on the following days ?

April 2.

1. Regulus.
2. Arcturus.
3. Sirius.

June 27.

7. Denebola.
8. Markab.
9. Arietis.

May 22.

4. Aldebaran.
5. Procyon.
6. Menkar.

August 12.

10. Bellatrix.
11. Betelgeux.
12. Altair.

And at what time will the fore-mentioned stars set on the above days ?

13. About the time that the Pleiades rise at 2 hours after sunset, the English farmers plant their wheat : on the 27th of October, at what time do they rise ?

14. The Dog-days are said to begin July 3 and end Aug. 11, which are a certain number of days preceding and fol-

lowing the heliacal\* rising of Sirius; but from the precession of the Equinoxes, they begin now several days later; required the time of Sirius's rising on the two days named.

## PROBLEM XII.

*To compute the Day of the Year when any Star will rise or set at a given Hour.*

**RULE.** Reduce the semi-diurnal arc into degrees, which will be the distance of the star from the degree of the Equinoctial which is upon the meridian at the given time, and the sun's place of right ascension on the required day will be distant from the degree on the meridian, as many degrees as are equal to the time before or after noon: then find the day of the month when the sun will have this right ascension for the day required.

*Ex. 1.* On what day will Regulus rise at two o'clock in the morning? Declination of Regulus is 13 deg.

	deg.	ho.	min.
Decl. of	11	=	7 .. 0
	2 × 6	=	0 .. 12

$$\text{Regulus's semi-arc } 7 \dots 12 = 108 \text{ deg.}$$

At the time of rising Regulus is distant from the meridian 108 deg., or that part of the horizon at which Regulus rises is 108 deg. from the meridian; and at the time of a star's rising and setting the given hour-line is on the meri-

\* Heliacal rising and setting of a star is when it rises a little before, and sets a little after, the sun.

dian, consequently, to find the day of the month, the student has only to find the noon hour-circle, and the day answering to this degree is the required day.

Regulus is 60 deg. upon the second quadrant, and this point is in the horizon East of the meridian; then we must remove 108 deg. to the West or right hand of 60 deg. on the second quadrant, to find the degree on the meridian, or deducting 108 deg. from 60 deg. on the second quadrant will make 42 deg. on the first quadrant on the meridian at two in the morning; and 30 deg. more to the right, or 12 deg. on the first quadrant, is midnight; and the same degree on the opposite quadrant is noon, which is twelve days after the 23d of September or the 5th of October.

*Ex. 2.* On what day of the year will Aldebaran rise at seven in the evening?

Declination of Aldebaran is 16 deg. N.

	deg.	m.	ho.	miu.
Semi-diurnal arc for 11	=	7	..	0
Ditto	for	5 × 6	=	0 .. 30

Semi-diurnal arc of the star 7 .. 30 =  $112\frac{1}{2}$  deg.

The star is 66 deg. upon the first quadrant, which, when rising, is 7 ho. 30 m., or  $112\frac{1}{2}$  deg. from the meridian in the eastern horizon; then 112 deg. to the West or right of 66 deg. on the first quadrant, is the degree on the meridian at 7 in the evening: 66 deg. on the first quadrant is 66 deg. from Aries, or 156 deg. from Capricornus; then  $156 - 112 = 44$  deg. from Capricornus, or 44 deg. on the fourth quadrant, is the degree on the meridian at 7 in the evening; and  $44 - 15 = 29$  deg. on the fourth quadrant is 6 in the evening, and 29 deg. on the third quadrant is noon, or 1 deg. in Scorpio, which answers to the 24th of October.

*Noté.* The meridian is always to the right or West of the star when rising, and to the left or East when setting.

2. On what days of the year will Menkar, Arietis, Procyon, and Regulus, rise at four in the morning; and on what days will Denebola, Arcturus, Betelgeux, and Altair, set at five in the afternoon?

3. Trincomale, in Ceylon, was captured by the English on that day, in August 1795, when Regulus was rising to England at 4 ho. 29 min. in the morning; what was the day?

4. Lord Falkland was slain in the battle of Newbury, in Berkshire, in 1643, on the day that Betelgeux set at 35 min. past noon; required the day of the month.

N. B. The distance between two stars may be found by Problem XXVIII. p. 186.

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### PROBLEM XIII.

*To find the Oblique Ascension and Descension of the Sun or a Star, or that Degree of the Equinoctial which rises and sets with the Sun or a Star.*

RULE. Take the ascensional difference from the right ascension of the sun or a star to find the oblique ascension, and add them together for the oblique descension, when the declination is North; but when South, their sum is the oblique ascension, and their difference is the oblique descension.

*Ex. 1.* Find the oblique ascension and descension of the sun on May 21.

deg. ho. min. deg.  
 The decl. is  $20\frac{1}{4}$  N., ascenl. diff. is 1 .. 55, or  $28\frac{3}{4}$ .  
 The right ascension is 58 deg.

deg. deg. deg.  
 Then  $58 - 28\frac{3}{4} = 29\frac{1}{4}$  oblique ascension.  
 And  $58 + 28\frac{3}{4} = 86\frac{3}{4}$  oblique descension.

*Ex. 2.* Find the oblique ascension and descension of Regulus.

deg. ho. min. deg.  
 Regulus is 13 N. decl. ascenl. diff. 1 .. 12, or 18, and right asc. 60 deg. on second quadrant, or 150 deg.

deg. deg. deg.  
 Then  $150 - 18 = 132$  oblique ascension.  
 $150 + 18 = 168$  oblique descension.

Find the oblique ascension and descension of the sun on June 21, July 23, August 23, and December 22; also of Menkar, Altair, Regulus, and Procyon.

## PROBLEM XIV.

### OF THE MOON.

The moon (Luna) in astronomy, is one of the heavenly bodies, frequently classed among the planets, but more properly accounted a satellite, or secondary planet.

#### EPACT.

The epact is the moon's age at the beginning of the year, the increase of which is 11 days yearly, being the excess of days in a solar year, or 365 days over the moon's 12 lunations, or 354 days.



*To find the Epact.*

RULE. Divide the given year by 19,\* multiply the remainder by 11, and the product is the epact when it is less than 30; when it is more, divide it by 30, and the remainder is the epact.†

Find the epact for 1831.

$$19 \overline{)1831} 96$$

$$171$$

$$\hline 121$$

$$114$$

$$\hline 7$$

$$11$$

$$30 \overline{)77} 2$$

$$60$$

$$\hline 17 \text{ Epact.}$$

What is the epact for the following years: 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1876, 1736?

## PROBLEM XV.

*To find the Moon's Age.*

RULE. Add together the epact of the year, number of the month, and the day of the month; if the sum is under

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\* Nineteen years is a period of the moon called a cycle, after which the new and full moons fall on the same days of the month as they did at the beginning of the period.

† Eleven days added to the epact of any year will give the epact for the year following.

30, it is the moon's age ; but if more, then subtract 30 from it, and the remainder is the age.

Because the new moons fall on every 30th day, and as the months contain, some more and some less than 30 days, there will arise a difference to be added for each month as follows :

No. of each month,											
Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
0	1	0	1	2	3	4	5	7	7	9	9

In leap-year \* observe to add one more for all the months except January.

Ex. Find the moon's age on July 6th, 1831.

Epact, No. Day.

$$17 + 4 + 6 = 27 \text{ age.}$$

Find the moon's age on May 24, 1832.

1832 is leap-year.

Epact No. Day.

$$28 + 3 + 24 = 55 - 30 = 25 \text{ age.}$$

Find the moon's age on the following days and years :

- |                  |                      |
|------------------|----------------------|
| 1. June 4, 1829. | 9. Feb. 13, 1836.    |
| 2. July 17,      | 10. March 17,        |
| 3. August 4,     | 11. April 3,         |
| 4. Sep. 15,      | 12. May 12, 1847.    |
| 5. Oct. 19,      | 13. June 14,         |
| 6. Nov. 3, 1832. | 14. July 16,         |
| 7. Dec. 4,       | 15. August 31, 1863. |
| 8. Jan. 3,       | 16. Sep. 2.          |

---

\* When the given year will divide by 4 without a remainder it is leap-year.

## PROBLEM XVI.

*To find the Time of the Moon's Southing or Passing the Meridian.*

*Obs.* The moon's diurnal motion varies from about 11 deg. 46 min. to 15 deg. 16 min., making a mean daily rate of about 12 deg. or 48 min. of an hour, then  $\frac{48}{60} = \frac{4}{5}$  of an hour.

If the moon came South one hour later daily, then the hour of her southing would be easily known by her age ; but as she souths  $\frac{4}{5}$  of an hour later,  $\frac{4}{5}$  of the age will be the time she souths after noon on any day.

**RULE.** Find the age, multiply it by 4 and divide the product by 5 for the hours, and if there be a remainder, multiply it by 12 for the minutes nearly that she souths after noon.

*Ex. 1.* At what hour will the moon be South on Dec. 2, 1831 ?

ho.    min.

$17 + 9 + 2 = 28$  age.     $28 \times 4 = 112 \div 5 = 22 \dots 24$  past noon.

2. At what hour will the moon South on Nov. 8, 1831 ?

$17 \times 9 \times 8 = 34 - 30 = 4$  age

4  
—  
5)16

—    min.

3  $\dots$  12 in the afternoon.

At what hours will the moon South on the following days and years ?

July 6, 1829.	Mar. 3, 1849.	Dec. 3, 1836.
Mar. 7,	May 7, 1832.	July 9, 1832.
April 8,	June 18,	Sept. 11,
May 11, 1830.	Aug. 3, 1830.	Mar. 4,
June 12,	Sept. 2,	June 3,
Jan. 17, 1849.	Oct. 4,	July 7.
Feb. 12,	Nov. 9, 1836.	

Sir Thomas Overbury was poisoned in the Tower, Sept. 15, 1613; what was the moon's age on that day?

Dr. Johnson was born at Litchfield, Sept. 18, 1709; required the moon's age on that day.

How old was the moon when Jerusalem was destroyed by Titus, in Aug. 30—70 according to the present style?

### PROBLEM XVII.

*To find the Moon's Place \* at the Time of her Southing, on any given Day of the Year.*

**RULE.** Find the time of the moon's southing, and the part of the Equinoctial South at that time; the degree of the Ecliptic answering to it is her place.

**Ex. 1.** What is the moon's place at the time of southing on December 6th, 1831?

\* The moon enlightens the North Pole when she is on the first and second quadrants, and the South Pole when she is on the third and fourth quadrants.

When the moon, or any planet, is at its nearest distance from the earth, it is said to be in *perigee*, and when at its furthest distance, in *apogee*. Its quickest motion is in the former, and its slowest in the latter situation.

$$17+9+6=32-30=2 \text{ Age.}$$

$$\begin{array}{r} 4 \\ \hline 5 \end{array} 8$$

1.36 the moon was South.

The sun's R. A. on December 6, is  $8+6+58 \text{ deg.} = 72 \text{ deg.}$  on the third quadrant or noon; and 1 hour 36 minutes  $= 24 \text{ deg.}$  or 24 past 72 deg. on the third quadrant; which is 6 deg. on the fourth quadrant, or 6 deg. in Capricornus.

Find the moon's place in the Ecliptic at the time of southing as follows :

- |                    |                    |
|--------------------|--------------------|
| 1. May 24, 1830.   | 5. Sept. 3, 1849.  |
| 2. June 16, 1830.  | 6. Sept. 18, 1849. |
| 3. July 5, 1831.   | 7. August 9, 1830. |
| 4. August 2, 1831. | 8. Nov. 3, 1831.   |

Suppose Bonaparte landed at St. Helena at 10 in the evening on the 13th October, 1815, was it moon-light at that time; and what were the time of the moon's southing and her longitude?

Robert Blake died, as the fleet which he commanded entered Plymouth Sound, in 1657, on August 17; what were the moon's age and place in the Ecliptic on that day?

### PROBLEM XVIII.

*To name what Stars are East and West of the Moon, and their Equinoctial Distances from her, at any Hour on any Day of the Year.*

**RULE.** Find the moon's place or right ascension at the given hour: then the stars upon the quadrants to the left

of the moon's place, and to the same degree on the next quadrant to the left will be East of the moon, and those on the right of the moon's place, and all those within the same degree on the next quadrant to the right, will be West of the moon; and the distances of the stars will be found by taking their difference of R. A. upon the quadrants between them and the moon's R. A.

Ex. Required what stars will be East and West of the moon on November 9, 1831, at 4 in the afternoon.

$9+9+17=5 \times 4=20 \div 5=4$  P. M. time of southing. On November 9, the sun is 17 deg. in Scorpio, or 45 deg. on the third quadrant; then 45 deg. on the third quadrant is South at noon; and at 4 o'clock 45 deg. + 60 deg. = 105 or 15 deg. upon the fourth quadrant was South, when the moon southed being the 4 o'clock hour-line; then the stars East of the moon are Altair, Markab and Fomalhaut. The chief stars West of the moon are Antares and Spica Virginis.

Altair is distant from the moon,  $25^{\circ}-15^{\circ}=10^{\circ}$  of R. A.

Markab..... 74 — 15 = 59

Fomalhaut..... 76 — 15 = 61

Antares is distant from Capricor-

nus ..... 25 + 15 = 40

Spica ..... 71 + 15 = 86

The moon advances in her orbit 13 deg. 10 min. daily, therefore her right ascension can be found at any hour from her southing, by adding or subtracting for the increase of right ascension in proportion as the time is before or after southing. Thus, if it should be six hours before southing that you want to know her right ascension, then 6 being  $\frac{1}{4}$  of 24, take  $\frac{1}{4}$  of 13 deg. or 3 deg. from the right ascension at southing for the right ascension nearly, which



cannot be correctly obtained, as the moon's rate per day is so variable.

What chief stars are East and West of the moon as follows :

1. May 24, 1832, at 6 P. M.
3. May 29, 1834, 6 P. M.
2. June 18, 1833, at 7 P. M.
4. June 21, 1849, 3 P. M.

5. Kosciusko was defeated near Warsaw, October 10, 1794. What stars were East and West of the moon on that day at 11 P. M. ?

6. Cortez entered Mexico, in North America, November 8, 1519, at 8 A. M. What stars were East and West of the moon on that day ?

#### PROBLEM XIX.

*To find the Moon's Nodes or the Points where her Orbit round the Sun cuts the Ecliptic.*

Obs. The Nodes' mean annual retrograde motion is 19 deg. 20 min. nearly, or 1 deg. 35 min. monthly. The part of the Ecliptic where the moon ascends from the South towards the North of the Ecliptic is the North ascending node, and is marked ♈. The other, South or descending node, which is on the same degree on the opposite quadrant, is marked ♎. The motion of the nodes is contrary to the order of the signs, and they complete a revolution from any point of the Ecliptic to the same point again in 18 years, 228 days, 9 hours. The moon's conjunction and opposition are called Syzygies, and the Quartile aspects, the Quadratures.

Rule. Find the moon's node on January 1, or any other

month, in an ephemeris; then find the number of months between January and the given time, and multiply the rate per month by this time, and deduct the product from the node on January 1, for any time after, but for any time before, add the product to the node for January in the given year.

**Ex.** The moon's ascending node for January 1, 1831, was 3 deg. 40 min. in Virgo; what was the place on May 15th?

The number of months between January and May 15th are  $4\frac{1}{2}$ .

Sign.

Then  $1^{\circ} 35' \times 4\frac{1}{2} = 7^{\circ} 7'$  then  $5 : 3^{\circ} 40'$

7 7.

4 : 28 : 33, or  $28^{\circ} 33'$  in Leo.

Find the moon's node on March 2, 1831.

From January to February are 2 months; then  $1^{\circ} 35' \times 2 = 3^{\circ} 10'$ .

From from  $3^{\circ} 40'$  in Virgo.

3 10

0 30 in Virgo.

Find the moon's node on the following days:

May 1, August 15, September 25, November 2, February 15, July 26, August 29, December 25, October 18, March 28, June 15, April 17.

### PROBLEM XX.

*To find the Day of the Month when an Eclipse of the Sun or Moon will take place.*

**RULE.** Find the time that the sun's place, and the

moon's nodes agree, or are in the same degree ; then find the days on which the new and full moons take place, and if the moon be less than 17 deg. from either of her nodes or the sun's place at the time of new moon, the sun will be eclipsed ; and if the moon be less than  $11\frac{1}{2}$  deg. from either of her nodes, the moon will be eclipsed.

Ex. On what days will the sun and moon be eclipsed when the sun passes the descending node in 1831 ?

By White's Ephemeris the ascending node for January 1 was 3 deg. 40 min. in Virgo, and the descending was on the same degree on the opposite quadrant, or 3 deg. 40 min. in Pisces ; the sun will pass this point on February 22, and the node has retrograded from January 1, to February 22, nearly 2 months ; then 1 deg. 35 min.  $\times 2 =$  3 deg. 10 min. gone backwards, towards Capricornus ; thus, 3 deg. 40 min.  $-$  3 deg. 10 min.  $=$  0 deg. 30 min. in  $\text{X}$  ; the moon's node and the sun's longitude will agree with this on February 19 ; the moon's age on this day is  $19 + 1 + 17 = 7$  days old, consequently the nearest new moon to the 19th was on the 12th of February. Now the sun's longitude on

Sign. Deg.

Feb. 12, is  $23^\circ$  in  $\text{æ}$  or 10 : 23 : 0' Take  
The moon's node\* to the  
end of February is ..  $0^\circ 30'$  in  $\text{X}$  or 11 : 0 : 30' From

The difference being less }  
than 17 deg. the sun is } ..... 7 : 30 Diff.  
eclipsed on the 12th .. }

The nearest full moon to the 19th of February, as the

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\* Since the moon's node is so trivial in its daily motion, in taking it for the exact day is of no consequence.

moon was 7 days old on that day, will be 8 days after, or on the 27th of February; and

The sun's longitude on February 27th is  $8^{\circ}$  in  $\times$

The moon's node to the end of Feb. is . 0 30' in  $\times$

The difference being less than  $11\frac{1}{2}$  deg. }  $7^{\circ} 30'$  Diff.  
the moon is eclipsed on the 27th .. }

Obs. The average number of eclipses is four, the greatest number seven, the least number two—and then, they are both of the *sun*.

Find on what days the sun and moon will be eclipsed in the following years :

1832, 1833, 1834, 1835, 1836, 1837, 1839, 1840, 1841, 1842, and 1843.

### HARVEST MOON.

Near the time of the autumnal Equinox, the moon at the time of the full rises sooner after sun-set than she does in any other full moon-week in the year: and at this time there is very little difference in the time of her rising for several nights together. Before the science of astronomy had developed the cause of this full moon, agriculturists ascribed it to the goodness of God alone, conceiving it ordered on purpose to afford them a greater portion of light from the moon after sun-set, for the better gathering in of the fruits of the earth; hence they distinguish this moon from others by the appellation of the harvest-moon. To illustrate this by the globe :

As the moon's daily motion in the Ecliptic is about  $12\frac{1}{4}$  deg., then if very small pieces of paper be put quite round the Ecliptic on the globe, at the distance from each

other of her mean daily motion, of  $12\frac{1}{4}$  deg. (beginning at Capricornus), then rectify the globe for the latitude of the place, and turn it round westward; it will then be seen that the different spots of paper on the Ecliptic, as they rise in the East, make very different angles with the horizon, and, of course, in equal times very unequal portions of the Ecliptic will be raised above the horizon. Seven of the spots of paper near Pisces and Aries will rise in about two hours of the hour circle; but in the opposite signs, Virgo and Libra, the hour circle will pass over eight hours during the rising of seven of the spots; and, in all the other signs between Aries and Libra, will partake of these differences, according as their distance is more or less remote from the Equinoctial points: therefore it is clear, that when the moon is in Pisces and Aries, the difference of time in her rising will be little more than two hours in a week, but in the two opposite signs the difference of rising will be about eight hours, which occurs every month, as the moon traverses her orbit in about that time.

As the moon is in opposition to the sun when she is full, and in the harvest months the sun is always in Libra or Virgo—therefore the moon at the full must be in Pisces or Aries, where this least difference occurs, and when she rises for several nights together soon after the sun sets.

The finest or highest harvest moons will take place when the node (when the moon's path crosses the Ecliptic) is in Cancer, for then she adds latitude to declination, which occurs every nineteen years, or the time which the nodes take in completing a revolution: there will be a regular period of all the varieties that can happen during that time in the rising and setting of the moon.

Find in what years the harvest moons will be most beneficial from 1831 to 1860 inclusive.



## MISCELLANEONS QUESTIONS.

1. What time will the moon be South on June 29, 1837 ?

2. At what hour will Altair culminate July 24 ?

3. Find the day of the month when Regulus culminates at 5 in the afternoon.

4. When the Whale is on the meridian, what constellations are at the East and West points of the horizon ?

5. Find the moon's place in the Ecliptic for May 27, 1836.

6. April 2, 1801. Lord Nelson gained a complete victory over the Danes off Copenhagen, in latitude 56 deg., and longitude 13 deg. E. ; at what time did Arietis, Menkar, Capella, Regulus, and Arcturus culminate on that day at that place, and what was their meridian altitude at Copenhagen, Petersburg, Jerusalem, and Constantinople ?

7. September 13, 1759, the heroic Wolfe was killed at Quebec in Canada. What was the sun's declination on that day ; the length of the day and night ; near what stars was the sun ; at what time did Regulus rise, culminate, and set, to England on that day ?

8. May 24, 1543, died Copernicus, whose genius led him to the study of astronomy ; he taught the system of Pythagoras at Rome. If he died about  $4\frac{1}{2}$  P. M., what constellations were southing ; and at what time did Procyon rise on that day ?

9. If the sun set at 7 o'clock in the evening, at what time does it rise, and what is the length of the day ?

10. When the sun's longitude is 4 signs, 21 deg., what is his declination ; what is the length of the day ; and what will be his distance from Arcturus and Regulus ?

11. Regulus is upon the meridian at London, March 29 ; when my watch is 5 P. M., is it right ?



12. On what days of the year will Arietis, Menkar, and Regulus come to the meridian with the sun ?

13. August 26, 55 B. C., near Dover, landed Julius Caesar at 10 in the forenoon, with an intention to subdue Britain ; what was the sun's declination, to what place was it vertical on that day at noon, and at what time did the moon south ?

14. October 13, 1815, arrived at St. Helena Napoleon Bonaparte ; what was the meridian altitude of the sun on that day ; and to what place was it vertical at noon ; and had St. Helena moon light at 9 in the evening on that day ?

15. What is the sun's altitude to the inhabitants of Constantinople at noon on September 2 ; and to what place in North latitude is it vertical at that time ?

16. Copernicus was born at Thorne, and died May 24, 1543 : what was the sun's declination at noon ; what constellations were on the meridian of that place, long. 18 deg. E., and at what hour did Capella culminate there ?

17. Cook was killed at Owhyhee, long. 156 deg. East, and lat. 18 deg. South. When the sun was  $23\frac{1}{2}$  deg. North declination, what was its meridian altitude at that place, and what altitude at noon on Dec. 15th at the same place ?

18. Aug. 21, 1762, Lady Mary Wortley Montague died ; she accompanied her husband in his embassy to Constantinople ; what was the moon's age on that day ; what stars were on the meridian at 8 in the evening, and what was the sun's height above the horizon at noon, at Constantinople ?

19. Required the sun's right ascension, oblique ascension, and ascensional difference on July 27.

20. When the Dolphin is on the meridian South, what constellation is then on the North meridian ?

21. What day will have the same length as May 29 ?

22. Captain Phipps, on Aug. 10, 1773, was providentially liberated from his perilous situation, environed nine days with impenetrable barriers of ice in lat.  $80\frac{1}{2}$  deg. N. What are the sun's meridian altitude, the moon's southing, and her longitude? What stars were on the meridian with the sun and moon; what were the heights of Altair, Regulus, and Menkar, in lat.  $80\frac{1}{2}$  deg. N., and the times of their rising and setting on that day to England?

23. Nov. 16, 1776, died James Ferguson, for a considerable time a shepherd, and afterwards an eminent astronomer; what were the moon's age, and her time of southing; the time that Alphacca culminated; its altitude; the day of the month when it souths at 3 in the morning to England, and the sun's meridian altitude; also the constellations on the meridian of Calcutta at that hour?

24. Sept. 2, 1804, Harding, of Lilienthal, near Bremen, in the N. of Germany, on this day discovered Juno, called by Lalande, Harding. On what day of the month was the full moon; its longitude; and the stars East and West of her on Sept. 2, when southing? How many eclipses were there in that year; and on what days of the month did they take place?

25. 1636, Nov. 11, Cassini, the astronomer, observed the transit of Mercury over the sun's disk at Thury, at 43 min. past 10 in the morning, in lat. 49 deg. 11 min. N., long. 22 min. W.; what stars were on the South meridian, also on the North meridian; at what time did Arcturus rise, Regulus set, and what was the sun's meridian altitude at that place and day? What was the length of the day in England at that time?



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